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ANNUAL REPORTS

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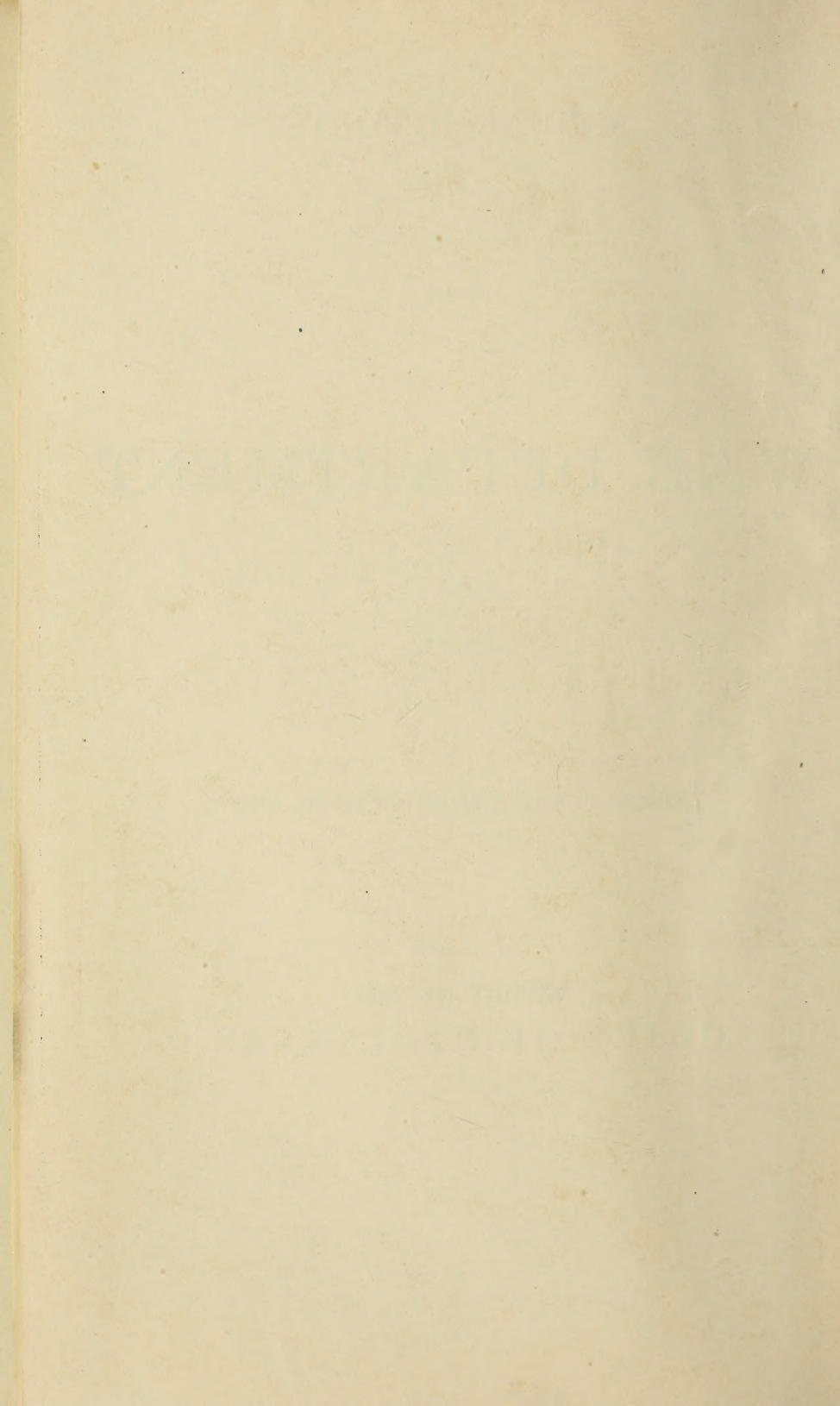
WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1901.

REPORT OF THE
CHIEF OF ENGINEERS.
PART 2.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1901.



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APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

(CONTINUED.)

RIVERS AND HARBORS, ETC.

APPENDIX A.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE EAST OF AND INCLUDING PORTLAND HARBOR.

REPORT OF MAJ. S. W. ROESSLER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|--|
| 1. Lubec Channel, Maine. | 7. Penobscot River, Maine. |
| 2. Narraguagus River, Maine. | 8. Rockland Harbor, Maine. |
| 3. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Maine. | 9. Carvers Harbor, Vinal Haven, Maine. |
| 4. Harbor at Sullivan Falls, Maine. | 10. Georges River, Maine. |
| 5. Union River, Maine. | 11. Kennebec River, Maine. |
| 6. Bagaduce River, Maine. | 12. Portland Harbor, Maine. |

EXAMINATION AND SURVEY.

13. Portland Harbor, Maine.

HARBOR LINES.

- | | |
|---------------------------------------|---|
| 14. Lubec Harbor, Maine. | 16. Portland Harbor, Maine, including Fore River and Back Cove. |
| 15. Penobscot River at Bangor, Maine. | |

UNITED STATES ENGINEER OFFICE,
Portland, Me., July 12, 1901.

GENERAL: I have the honor to forward annual report for the fiscal year 1901, for river and harbor works in my charge.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

A 1.

IMPROVEMENT OF LUBEC CHANNEL, MAINE.

The approved project and the report of the progress of the work up to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 120.

The expenditures during the fiscal year were \$25,314.03. Dredging under contract with Augustus R. Wright, which was commenced June 22, 1900, was completed October 19, 1900, 86,959 cubic yards of material being removed during the fiscal year and a total of 96,114 cubic yards under the contract. The widening of the channel on the westerly side was thereby completed, and a strip about 2,500 feet long, varying in width from 35 to 67 feet, was dredged on the easterly side in the bend opposite Lubec Narrows light and below. This leaves a strip about 3,900 feet long, having a general width of about 130 feet, to be dredged from the middle and lower part of the entrance channel, on its easterly side, to complete its enlargement as projected.

It is proposed to use the additional appropriation recommended in widening the channel on the easterly side and possibly in doing some redredging.

This channel is an international passage. The tidal currents are very strong and dense fogs prevail a large part of the time.

The widening of the channel benefits navigation principally by decreasing the chances of stranding and of collision.

There is a light-house about 1 mile to the southward of Lubec, on the westerly side of the dredged channel. Lubec Narrows is in the collection district of Passamaquoddy.

Money statement.

July 1, 1900, balance unexpended	\$25,953.21
June 30, 1901, amount expended during fiscal year	25,314.03
July 1, 1901, balance unexpended	639.18
{ Amount (estimated) required for completion of existing project	53,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	53,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1879	\$44,000
June 14, 1880	20,000
March 3, 1881	45,000
August 2, 1882	20,000
July 5, 1884	10,000
August 5, 1886	10,000
August 11, 1888	20,000
August 18, 1894	5,000
August 18, 1894, unexpended balance for improving St. Croix River, made available for Lubec Channel	35,000
June 3, 1896	32,000
March 3, 1899	25,000
Total	266,000

Contract in force during the fiscal year ending June 30, 1901.

Name of contractor: Augustus R. Wright.

Date of contract: July 3, 1899.

Date of approval: July 19, 1899.

Time for commencement: October 1, 1899.

Time for completion: October 31, 1900.

Rates: Dredging, 25 cents per cubic yard; removing bowlders, \$5 per ton.

Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1896.....	52,300
1897.....	53,400
1898.....	87,000
1899.....	126,700
1900:	
Coal and wood.....	9,000
Fish and sardines.....	40,000
Lumber, brick, and lime.....	4,800
Provisions and grain.....	7,500
Salt and general merchandise.....	4,500
Sardine stock.....	11,000
Total.....	76,800

Arrivals and departures in calendar year 1900.

Steamers, draft 12 feet.....	450
Sailing vessels, average tonnage 74, draft 10 feet.....	267

The following is a letter from the collector of customs, port of Lubec, Me.:

LUBEC, January 27, 1901.

DEAR SIR: Inclosed please find commercial statistics for the port of Lubec, Me., for calendar year ending December 31, 1900.

The improvement of this channel is not altogether local. A large number of vessels go through the channel annually, using it as a sheltered route and for refuge during storms. In 1900 1,000 steamers and 5,000 sailing vessels passed through.

The masters of vessels tell me that the last dredging was a great improvement to the channel.

Respectfully,

WM. MERRIAM.

Mr. S. W. ROESSLER,

Major, Corps of Engineers.

A 2.

IMPROVEMENT OF NARRAGUAGUS RIVER, MAINE.

The approved project and the report of progress of the work up to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 121.

The expenditures during the fiscal year ending June 30, 1901, were \$147.85. No work was done during the fiscal year. The expenditures

were incurred in inspecting removal of fish weirs and investigating the matter of depositing sawmill waste in the river above.

The improvement is in the collection district of Machias. The nearest port of entry is Machias. The nearest light-house is Narraguagus light-house, on Pond Island.

Money statement.

July 1, 1900, balance unexpended	\$564. 04
June 30, 1901, amount expended during fiscal year.....	147. 85
July 1, 1901, balance unexpended	416. 19

APPROPRIATIONS.

For improvement above Millbridge:		
Act of March 3, 1871	\$12, 000	
Act of June 10, 1872.....	10, 000	
		\$22, 000
For improvement below Millbridge:		
Act of August 5, 1886.....	10, 000	
Act of August 11, 1888.....	10, 000	
Act of September 19, 1890.....	7, 500	
Act of July 13, 1892	7, 500	
Act of August 18, 1894.....	5, 000	
Act of June 3, 1896.....	5, 000	
Act of March 3, 1899	5, 000	
		50, 000
Total		72, 000

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1891.....	48, 959
1892.....	45, 300
1893.....	60, 875
1894.....	95, 600
1895.....	54, 750
1896.....	16, 175
1897.....	41, 500
1898.....	26, 147
1899.....	23, 545
1900:	
Brick.....	125
Coal.....	1, 000
Grain and flour	2, 000
General merchandise	9, 000
Hard-pine lumber.....	900
Hoop poles	300
Iron, and iron pipe.....	150
Lime and cement	150
Lobsters, clams, and other fish.....	500
Lumber	17, 000
Sardines, sardine supplies, and canned goods.....	3, 500
Wood	1, 200
Total	35, 825

Arrivals and departures in calendar year ending December 31, 1900.

Steamers, average draft 8½ feet	400
Sailing vessels, draft 9 feet	350

A 3.

BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, BAR HARBOR, MAINE.

The approved project and the report of progress of the work up to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 122.

The expenditures during the fiscal year 1901 were \$14,713.95. Under contract with William S. White the work of depositing stone on and in continuation of the breakwater begun April 28, 1900, was completed September 21, 1900. During the fiscal year 9,393 tons of stone were furnished and placed in the work, and 23,291 tons under the entire contract. Most of this stone has been used in raising to full height and section the part of the old work which had settled or been lowered by the action of the waves. The length of the breakwater as built west of Dry Ledge is about 731 feet, and the total projected length of that portion is 1,440 feet.

The beneficial effects resulting from the portion of the breakwater already built in protecting the wharves at Bar Harbor and the anchorage basin are very appreciably felt.

The breakwater will require more or less extensive repairs until the side slopes have assumed an angle of rest against wave action.

It is proposed to apply the additional appropriation recommended in continuing the breakwater from Dry Ledge toward Mount Desert Island, and in rebuilding to full height and section such parts of the breakwater already built as may have settled or have been disturbed by wave action.

The benefits to navigation are general in providing a harbor of refuge and local in making it possible for boats to land at the wharves at all times with safety. The only convenient method of transportation to and from Bar Harbor is by boat.

Bar Harbor is in the collection district of Frenchman Bay. The nearest port of entry is Ellsworth. The nearest light-house is on Egg Rock, $3\frac{1}{2}$ miles distant.

Money statement.

July 1, 1900, balance unexpended	\$15,005.23
June 30, 1901, amount expended during fiscal year	14,713.95
July 1, 1901, balance unexpended	291.28
{ Amount (estimated) required for completion of existing project	230,200.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 11, 1888	\$50,000	June 3, 1896	\$10,000
September 19, 1890	50,000	March 3, 1899	20,000
July 13, 1892	50,000		
August 18, 1894	10,000	Total	190,000

Contract in force during fiscal year ending June 30, 1901.

Name of contractor: William S. White.
 Date of contract: February 17, 1900.
 Date of approval: March 5, 1900.
 Time for commencement: May 11, 1900.
 Time for completion: December 11, 1900.
 Rate: 78 cents per ton.
 Contract completed.

COMMERCIAL STATISTICS.

It has been impracticable to obtain commercial statistics for 1900, but for 1898 it was reported as 22,175 tons and for 1899 as 24,393 tons.

A 4.

IMPROVEMENT OF HARBOR AT SULLIVAN FALLS, MAINE.

The approved project and the report of progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 123.

There were no expenditures during the fiscal year 1901, and no work was done.

It is proposed to use the additional appropriation recommended in excavating the ledges to a depth of 10 feet at mean low tide in accordance with the project.

Sullivan Falls is in the collection district of Frenchman Bay. The nearest light-house is Crabtree Ledge light station.

Money statement.

July 1, 1900, balance unexpended	\$464. 69
July 1, 1901, balance unexpended	464. 69
{ Amount (estimated) required for completion of existing project	25, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	15, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of March 3, 1871	\$10, 000
Act of June 10, 1872	25, 000
	\$35, 000
Act of June 3, 1896	5, 000
Act of March 3, 1899	5, 000
	10, 000
Total	
	45, 000

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1896.....	51,290
1897.....	50,790
1898.....	41,700
1899.....	42,125
1900:	
Coal.....	120
General merchandise.....	1,000
Granite and paving blocks.....	32,906
Hay and grain.....	1,000
Lumber and wood.....	900
Total.....	35,926

Arrivals and departures during calendar year 1900.

Sailing vessels, average 200 tons, average draft 12 feet	177
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A 5.

IMPROVEMENT OF UNION RIVER, MAINE.

The approved project and the report of progress of the work to June 30, 1901, will be found in the report of the Chief of Engineers for 1901, Part I, page 124.

The expenditures during the fiscal year 1901 were \$13,055.11. Dredging under the existing project was continued with one small clam-shell machine until November 15, 1900, when work was suspended for the season, at which time a channel about 2,500 feet long from the Narrows to the lower wharves at Ellsworth had been dredged to a width of about 120 feet and a depth of about $3\frac{1}{2}$ feet at mean low tide, 44,452 cubic yards, measured in scows, of sawmill waste and loose gravel, at 25 cents per cubic yard, and 121 cubic yards, scow measurement, of hard pan and boulders, at 75 cents per cubic yard, having been removed. Work was resumed under this contract in the latter part of May, 1901. One dredge began work at the mouth of the river May 28, removing sawdust and mud, at 18 cents per cubic yard, scow measurement; another began May 29, 1901, dredging slabs, edgings, etc., from the channel immediately above the Narrows, at 25 cents per cubic yard, and the third machine started in May 31, 1901, just below the Narrows, to excavate hard pan and boulders at 75 cents per cubic yard, scow measurement, and a part of the material classed as ledge at \$6.40 per cubic yard, place measurement.

At the end of the fiscal year the following material had been removed since the resumption of work in May, 1901:

48,605 cubic yards, scow measurement, of material, mostly sawdust and mud, at mouth of river, at 18 cents per cubic yard.
 11,474 cubic yards, scow measurement, slabs, edgings, etc., at 25 cents per cubic yard.
 548 cubic yards, scow measurement, hard pan and boulders, at 75 cents per cubic yard.
 980 cubic yards, place measurement, ledge, at \$6.40 per cubic yard.

A channel at the mouth of the river had been dredged to a depth of 6 feet, with a width of 200 feet for a distance of 600 feet, and a width

of 120 feet for a farther distance of 3,200 feet. At the lower end of the Narrows a channel had been obtained, through hard pan and boulders and ledge, 100 feet wide, 6 feet deep at mean low tide, and about 400 feet long. At the upper end of the Narrows the channel had been dredged to a width of 150 feet for a distance of about 1,000 feet. Full depth has not, however, been obtained throughout this section, the mill waste and loose gravel only having been removed.

At the time of the resumption of work in May, 1901, the entire proposed channel was again carefully sounded and it was found that fresh deposits, brought down during the last freshets, had completely obliterated the channel dredged below the wharves at Ellsworth last season, and had made the navigable channel more crooked and its condition worse than before the improvement was commenced. As a result of these new deposits boats drawing not more than the flow of the tide are the only ones that can reach the wharves at Ellsworth.

The soundings made show that to obtain the proposed width and depth of channel between the Narrows and the head of navigation where the fresh accretions are greatest, will require the removal of 8,000 cubic yards more of slabs and edgings than when the work was begun in May, 1900, and including the work done in the season of 1900, indicate a total fill in the channel, from 1899 to 1901, of 41,000 cubic yards, in situ where this total quantity of excavation in original survey was only 122,000 cubic yards. There has been no appreciable filling in the Narrows and immediately below. At the mouth of the river, however, the deposit of sawdust on the bar has so largely increased the amount of excavation that after 10 days' work it was found necessary to reduce the width of the channel to be dredged from 200 feet to 120 feet. It will require the removal of about 70,000 cubic yards of material to dredge a channel of the decreased width. A part of this increase in amount of dredging at this locality is due to the character of the material, the increase of scow measurement over place measurement being more than 50 per cent.

It was stated in the last annual report that "the improvement can not be regarded as permanent, as the masses of slabs and edgings and sawdust now within the banks of the river will gradually work into the channel and necessitate redredging. At the mills on the river, above the head of navigation, all the short sawdust and a part of the other waste materials go into the stream."

The shoaling since last season is, however, believed to be exceptional, as the freshet during the spring of 1901 was the highest known for years, and brought down vast quantities of refuse material from the banks above ordinary freshet height. But the most disastrous circumstance was the giving away of the dam at the head of tide water, thereby turning loose the accumulation of years of deposits of sawmill waste and silt in the pool above the dam into the river below, the slabs and sticks filling the channel above the Narrows and a large part of the sawdust being carried further down and deposited on the bar at the mouth of the river.

It is proposed to expend the available funds in dredging and ledge excavation in accordance with the project

Union River is in the collection district of Frenchman Bay. The nearest light-house is Blue Hill light.

Money statement.

July 1, 1900, balance unexpended	\$129, 287. 94
June 30, 1901, amount expended during fiscal year	13, 055. 11
July 1, 1901, balance unexpended.....	116, 232. 83
July 1, 1901, outstanding liabilities.....	1, 609. 22
July 1, 1901, balance available	114, 623. 61
July 1, 1901, amount covered by uncompleted contracts.....	108, 686. 24

APPROPRIATIONS.

July 11, 1870.....	\$15, 000	
March 3, 1871.....	15, 000	
		\$30, 000
June 3, 1896	15, 000	
March 3, 1899.....	15, 000	
June 6, 1900	115, 000	
		145, 000
Total		175, 000

Contract in force during fiscal year ending June 30, 1901.

Name of contractor: Augustus R. Wright.

Date of contract: October 16, 1899.

Date of approval: November 6, 1899.

Time for commencement: April 1, 1900.

Time for completion: In season of 1901.

Rate:

Dredging mill waste, 25 cents per cubic yard.

Dredging hardpan and bowlders, 75 cents per cubic yard.

Excavation of ledge, \$6.40 per cubic yard.

Dredging at mouth of river, 18 cents per cubic yard.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1896.....	54, 000
1897.....	57, 685
1898.....	50, 462
1899.....	49, 800
1900:	
Bricks.....	900
Cement and lime.....	200
Coal.....	3, 000
Fish.....	200
Gravel.....	200
Hardware and iron.....	400
Headings and staves.....	16, 400
Laths.....	1, 080
Lumber.....	13, 100
Miscellaneous.....	4, 000
Powder.....	15
Shingles.....	785
Wood.....	2, 300
Total	42, 580

Arrivals and departures during calendar year 1900.

	Number.	Gross tonnage.	Average draft.
Arrivals	225	150	<i>Feet.</i> 10
Departures	225	150	10

Vessels plying on the river, 3, and 1 tug boat.

A 6.

IMPROVEMENT OF BAGADUCE RIVER, MAINE.

The approved project and report of progress of the work to June 30, 1900, will be found in the report of the Chief of Engineers for 1901, Part I, page 125.

The expenditures during the fiscal year 1901 were \$2,732.56. The removal of rocks and bowlders from the 40-foot wide channel opposite Winslows Island, under contract with Townsend & Olsen, which was commenced June 15, 1900, was completed as far as practicable August 11 following, 418 tons being removed during the fiscal year, and a total of 501 tons under the contract, at the rate of \$1.59 per ton. An open market arrangement was then made with the same parties to continue the removal of bowlders over the entire width of the 100-foot channel at the same price. This work was completed September 15, at which time 976 tons additional had been removed, making a total of 1,477 tons removed under formal contract and informal agreement.

It is proposed to apply the additional appropriation recommended to continuing the channel as originally projected.

The improvement is in the collection district of Castine. The nearest port of entry is Castine, at the mouth of the river. The nearest light-house is at Dice Head.

Money statement.

July 1, 1900, balance unexpended	\$3,080.37
June 30, 1901, amount expended during fiscal year	2,732.56
July 1, 1901, balance unexpended	347.81
{ Amount (estimated) required for completion of existing project	21,875.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4. 1897.	

APPROPRIATIONS.

August 11, 1888	\$3,000	June 3, 1896	\$5,000
September 19, 1890	4,000	March 3, 1899	3,000
July 13, 1892	5,000		
August 18, 1894	5,000	Total	25,000

Contract in force during fiscal year ending June 30, 1901.

Name of contractor: Townsend & Olsen.
 Date of contract: May 7, 1900.
 Date of approval: May 21, 1900.
 Time for commencement: June 24, 1900.
 Time for completion: September 22, 1900.
 Rate: \$1.59 per ton.
 Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1891.....	41,300
1892.....	46,100
1893.....	49,300
1894.....	67,850
1895.....	85,900
1896.....	78,050
1897.....	86,600
1898.....	79,965
1899.....	89,500
1900:	
Bricks.....	12,000
Coal.....	2,500
Cod and mackerel lines.....	400
Cotton.....	350
Farm produce.....	250
Fish.....	300
General merchandise.....	25,000
Grain.....	12,000
Granite.....	2,000
Lumber and cooperage.....	17,000
Lime, cement, etc.....	8,000
Phosphate.....	200
Wood.....	6,000
Total.....	86,000

Arrivals and departures during calendar year 1900.

Steamers drawing 10 feet or more, 500 to 1,500 tons.....	200
Steamers drawing less than 10 feet, 5 to 250 tons.....	1,200
Sailing vessels drawing 10 feet or more, 150 to 400 tons.....	200
Sailing vessels drawing less than 10 feet, 5 to 150 tons.....	500

Most of the foregoing includes receipts and shipments at Castine, at the mouth of the river.

A 7.

IMPROVEMENT OF PENOBSCOT RIVER, MAINE.

The approved project and the report of progress of the work to June 30, 1900, will be found in the report of the Chief of Engineers for 1901, Part I, page 126.

The expenditures during the fiscal year 1901 were \$16,918.37. No work was done under the general project for improving Penobscot River.

By act of March 3, 1899, Congress appropriated \$28,000 for com-

pleting an improvement in the Penobscot River at Bangor, in accordance with project submitted May 3, 1897. The detailed plan under the project of May 3, 1897, as approved by the Secretary of War May 18, 1899, contemplates dredging at the mouth of the Kenduskeag and through both draws of the railroad bridge and within the basin between the latter bridge and the Post-Office Bridge, so as to obtain a uniform depth of about 1 foot above extreme low water (or 2 feet below mean low water) to within 30 feet of the wharves.

The same project also provides for deepening the harbor of Bangor in front of the Boston and Bangor steamboat wharf by the excavation of ledge to a depth of 11 feet at extreme low tide.

A contract has been entered into with Harries & Letteney for the work at both points, at \$7.65 per cubic yard for ledge excavation and 28.7 cents per cubic yard for dredging. Work was commenced at both places June 22, 1900.

During the fiscal year just ending 27,428 cubic yards of material have been dredged and 15 cubic yards of ledge excavated from the Kenduskeag River, completing this part of the project as approved by the Secretary of War May 18, 1899, with the exception of a small number of bowlders which will be removed after completion of the rock excavation in front of the Boston and Bangor steamer wharf. The progress at this latter place has been retarded considerably by unavoidable circumstances, and the time of completion of this contract has been twice extended, first to July 1, 1901, and, owing to the exceptionally high and long-continued spring freshets and a slight increase of the number of cubic yards of ledge to be excavated, again to October 1, 1901.

On June 13, 1901, the work of excavation in front of the Boston and Bangor steamer wharf was resumed and at the end of this fiscal year about 65 per cent of the ledge work had been completed.

Money statement.

July 1, 1900, balance unexpended	\$36,365. 87
June 30, 1901, amount expended during fiscal year	16,918. 37
July 1, 1901, balance unexpended	19,447. 50
July 1, 1901, outstanding liabilities	1,701. 19
July 1, 1901, balance available	17,746. 31
July 1, 1901, amount covered by uncompleted contracts	8,736. 92

APPROPRIATIONS.

March 2, 1829 (for survey)	\$300
July 11, 1870 (at Bangor and below)	15,000
March 3, 1871 (at Bangor and below)	50,000
June 10, 1872	40,000
March 3, 1873	20,000
June 23, 1874	20,000
March 3, 1875 (\$10,000 to be expended at or near Bucksport Narrows)	25,000
August 14, 1876 (\$4,000 to be expended at or near Bucksport Narrows)	10,000
June 18, 1878 (\$2,500, or so much thereof as necessary, to be expended at or near Bucksport Narrows)	12,000
March 3, 1879	6,000
July 5, 1884 (for Bangor Harbor and Penobscot River)	20,000

August 5, 1886 (for widening channel at Bangor and removing obstructions near Crobys Narrows)	\$15,000
August 11, 1888 (\$20,000 to be expended between Bangor and Crobys Narrows and \$30,000 between Bucksport and Winterport)	50,000
September 19, 1890 (for continuing improvement and for dredging near Sterns's mill)	25,000
July 13, 1892	40,000
March 3, 1899	28,000
Total	376,300

Contract in force during fiscal year ending June 30, 1901.

Names of contractors: Harries & Letteney.

Date of contract: November 20, 1899.

Date of approval: December 11, 1899.

Time for commencement: May 15, 1900.

Time for completion: October 1, 1901.

Rates:

Dredging, 28.7 cents per cubic yard.

Removing boulders, \$12 per cubic yard.

Ledge excavation, Kenduskeag stream, \$15 per cubic yard.

Ledge excavation, steamboat wharf, \$7.65 per cubic yard.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1891	931,780
1892	714,935
1893	565,887
1894	750,313
1895	617,859
1896	715,911
1897	790,698
1898	639,671
1899	658,632
1900:	
Cement and lime	16,910
Coal	351,907
Cooperage	13,948
Fertilizer	5,592
General merchandise	31,569
Grain, feed, and hay	17,222
Ice	173,809
Iron and steel	3,786
Lumber, wood, and spool bars	252,374
Oil	8,367
Salt	1,170
Sand and clay	3,533
Stone and paving	32,153
Sulphur	5,495
Total	917,835

Arrivals and departures in calendar year 1900.

Steamers	976
Sailing vessels	2,648
Total tonnage	1,187,446
Foreign:	
Steamers (total tonnage, 29,636)	22
Sailing vessels (total tonnage, 14,010)	34

A 8.

IMPROVEMENT OF HARBOR AT ROCKLAND, MAINE.

The approved project and the report of progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 128.

The expenditures during the fiscal year ending June 30, 1901, were \$129,864.39. Work of raising the shore end of the breakwater to full section and building a stone cap the entire length, has been carried on throughout the year except for a suspension of a couple of months during the severest part of the winter. The inner part has been raised to full height and section, about 2,785 feet of stone cap built out from the shore end and 209 feet in from the outer end, leaving about 1,351 feet to complete the contract. The cap at the outer end was made 39 feet wide to form a site for a permanent light and keeper's dwelling. Twenty-six thousand one hundred and thirty-one tons of stone have been placed in the work and the contract is about 75 per cent completed. An open market arrangement has been made with the contractor for the removal of six stone beacons from the breakwater at a cost of \$50 each, or \$300 for the removal of all of them. Five of these beacons have been removed. From recent examinations it was found that along the outer part of the breakwater on the sea side, where the slope was made 1 on 1, a number of large stone blocks had been displaced. In order to repair these weakened spots, prevent probable undermining of the capstones with the chances of possible breaches through the breakwater, and to strengthen this part of the work throughout, it was recommended that about 23,000 tons of stone, mostly heavy blocks, be placed on the outer slope for a distance of 2,300 feet near the outer end of the breakwater. This recommendation was approved by the Chief of Engineers June 19, 1901, and a formal contract for doing the work will be made as soon as practicable.

Dredging under contract with Moore & Wright was completed May 24, 1901. One hundred sixty-five thousand and eighty-seven cubic yards, place measurement, were removed during the fiscal year, and a total of 487,567 cubic yards under the contract. A recommendation was approved by the Secretary of War May 22, 1900, to pay the contractors an additional 3 cents, or a total of 17 cents, per cubic yard for removal of material from the area where the required depth was changed from 6 feet to 4 feet at mean low tide, said change of depth having been made on account of the discovery of ledge. A supplemental agreement embodying this modification was approved by the Secretary of War July 11, 1900.

To excavate the ledge first uncovered in November, 1899, to a depth of 7 feet at mean low tide, it has been estimated would require the removal of 1,475 cubic yards of rock, measured in place. Ledge has also been discovered at several points during the last fiscal year projecting above the grade of 4 feet at mean low tide. To take all these points off to the required grade would probably require about 500 cubic yards of excavation.

The necessity for the removal of any or all of the ledge has not as yet been definitely decided upon and an estimate therefor has not been made a part of the existing project.

Under contract with Dunbar & Sullivan the removal of the south ledges (D and E) has been completed to a depth of 22 feet at mean low tide and the Jameson Point ledges (A and C) have been removed to the required depth of 14 feet, with ledge B of same group nearly two-thirds removed to 14 feet. A total of 26,560 cubic yards of ledge has been removed, leaving about 3,613 cubic yards to complete the original contract. It was recommended that a small shoal known as "Lone Rock Shoal," discovered a short distance southwesterly from ledge B, with only 7 feet on it at low tide, be removed by the contractor to depth of 12 feet at low tide, at the rate of 75 cents per cubic yard, scow measurement. This material is compact gravel and boulders and it is estimated that about 1,000 cubic yards of dredging will be necessary to remove it to the required depth. A supplemental agreement embodying this work as recommended was duly executed March 29, 1901, and received the approval of the Secretary of War in April, 1901. The dredging has not yet been undertaken, but its completion will require only a few days.

It is proposed to expend the available funds in completing the stone cap on the breakwater, and in reenforcing the outer slope, and in ledge excavation.

Rockland is in the collection district of Waldoboro. There is a light on the end of the breakwater.

Money statement.

July 1, 1900, balance unexpended	\$292,468.98
June 30, 1901, amount expended during fiscal year	129,864.39
July 1, 1901, balance unexpended	162,604.59
July 1, 1901, outstanding liabilities	30,511.04
July 1, 1901, balance available	132,093.55
July 1, 1901, amount covered by uncompleted contracts	54,633.08

APPROPRIATIONS.

June 14, 1880	\$20,000	August 18, 1894	\$30,000
August 2, 1882	40,000	June 3, 1896	25,500
July 5, 1884	40,000	June 4, 1897	350,000
August 5, 1886	22,500	July 1, 1898	300,000
August 11, 1888	30,000		
September 19, 1890	37,500	Total	925,500
July 13, 1892	30,000		

Contracts in force during fiscal year ending June 30, 1901.

FOR DREDGING.

Name of contractor: Moore & Wright.
 Date of contract: May 16, 1898.
 Date of approval: June 8, 1898.
 Time for commencement: June 6, 1898.
 Time for completion: October 1, 1901.
 Rates: Dredging, 14 cents and 17 cents per cubic yard; removing boulders, \$5 per ton.
 Contract completed.

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FOR LEDGE EXCAVATION.

Name of contractor: Dunbar & Sullivan.
 Date of contract: July 9, 1898.
 Date of approval: August 22, 1898.
 Time for commencement: September 1, 1898.
 Time for completion: September 1, 1901.
 Rates: Removing ledges, \$6.75 and \$6.25 per cubic yard; removing Lone Rock Shoal, 75 cents per cubic yard.

FOR RAISING BREAKWATER.

Name of contractor: Romano V. Perini.
 Date of contract: June 2, 1900.
 Date of approval: June 18, 1900.
 Time for commencement: July 20, 1900.
 Time for completion: December 31, 1901.
 Rate: \$1.49 per ton of stone.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1891	433, 760
1892	526, 805
1893	538, 506
1894	509, 853
1895	615, 830
1896	580, 295
1897	594, 992
1898	579, 300
1899	755, 649

1900:	
Brick, cement, and sand	31, 500
Coal	70, 000
Fish, salt, etc	17, 000
Grain and flour	14, 000
General merchandise	78, 000
Hay and straw	1, 000
Ice	9, 000
Lumber and ship timber	33, 000
Oil	7, 000
Stone	80, 000
Sawdust and ashes	5, 000
Steel rails, iron work, and castings	2, 500
Wood and cooperage	55, 000
Lime	150, 000
Total	553, 000

Arrivals and departures in calendar year 1900.

Steamers:	
Coastwise, 400 to 1,500 tons each	693
Coastwise, 25 to 400 tons each	2, 171
Coastwise, under 25 tons	285
Sailing vessels:	
Foreign (tonnage not stated)	83
For refuge only	1, 250
Coastwise (tonnage not stated)	4, 175

A 9.

IMPROVEMENT OF CARVERS HARBOR, VINALHAVEN, MAINE.

The approved project and the report of progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 129.

There were no expenditures during the fiscal year 1901. No work was done. It is proposed to apply the balance on hand and additional appropriation recommended to the completion of the project.

Carvers Harbor is in the collection district of Belfast. The nearest light-house is Heron Neck.

Money statement.

July 1, 1900, balance unexpended	\$788. 86
July 1, 1901, balance unexpended	788. 86
{ Amount (estimated) required for completion of existing project	39, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	39, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

June 3, 1896	\$10, 000
March 3, 1899	15, 000
Total	25, 000

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1896	63, 078
1897	63, 704
1898	60, 000
1899	63, 390
1900:	
Coal, hay, wood, lumber, and general merchandise, etc.	9, 200
Lobsters	600
Fish, salt, ice, bait, etc	13, 000
Stone	41, 700
Total	64, 500

Arrivals and departures in calendar year, 1900.

Sailing vessels:	
Draft 9 to 18 feet, 100 to 400 tons	170
Draft 7 to 14 feet, 7 to 200 tons	580
Steamers and vessels arriving for refuge	480
Boats making about 7,000 trips in a year, draft 4 to 8 feet	100
Three sloop yachts were built in the year 1900 of about 20 tons each.	

A 10.

IMPROVEMENT OF GEORGES RIVER, MAINE.

The approved project and the report of progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 130.

There were no expenditures during the fiscal year 1901. No work was done. It is proposed to apply the additional appropriation recommended to the completion of the project by dredging.

Georges River is in the collection district of Waldoboro. The nearest light-house is Franklin Island.

Money statement.

July 1, 1900, balance unexpended	\$212. 62
July 1, 1901, balance unexpended	212. 62
{ Amount (estimated) required for completion of existing project	6,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	6,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of June 3, 1896	\$10,000
Act of March 3, 1899	10,000
Total	20,000

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1896	45,375
1897	64,250
1898	59,000
1899	60,000
1900:	
Bricks	175
Cement and general merchandise	250
Coal	5,000
Farm produce and grain	800
Lime	10,000
Lumber	5,000
Wood	8,000
Total	29,225

Arrivals and departures in calendar year 1900.

Sailing vessels, coastwise:	
Drawing 10 feet or more, average 350 tons	20
Drawing less than 10 feet, 75 to 350 tons	125
Barges, 25 to 50 tons	40
Sailing vessels, foreign, average 100 tons	20
Vessels built in 1900	tons.. 4,171
Vessels in process of construction	do.. 1,000

A II.

IMPROVEMENT OF KENNEBEC RIVER, MAINE.

The approved project and the report of progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 130.

The expenditures during the fiscal year 1901 were \$54.56. No work was done. The expenditures were incurred in inspecting the river by the division and district engineer officers.

Of the available balance \$20,000 is held for future allotment and the remainder for any repairs that may become necessary to Beef Rock Jetty.

The improvement is in the collection district of Bath, of which Bath is the port of entry. Fort Popham and the light-house on Pond Island are near the mouth of the river.

Money statement.

July 1, 1900, balance unexpended	\$27,689.21
June 30, 1901, amount expended during fiscal year	54.56
July 1, 1901, balance unexpended	27,634.65

APPROPRIATIONS.

March 2, 1827	\$4,000	June 23, 1874	\$12,000
March 19, 1828	3,500	March 3, 1875	15,000
April 23, 1830	5,000	March 3, 1881	10,000
August 30, 1852	6,000	August 11, 1888	75,000
June 23, 1866	20,000	September 19, 1890	50,000
March 2, 1867	30,000	July 13, 1892	100,000
April 10, 1869	14,850	August 18, 1894	50,000
July 11, 1870	15,000	June 3, 1896	55,000
March 3, 1871	15,000		
June 10, 1872	8,000	Total	500,350
March 3, 1873	12,000		

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1891	1,210,474
1892	1,263,145
1893	970,938
1894	1,207,965
1895	1,162,972
1897	665,991
1898	1,211,808
1899	714,199
1900:	
Bricks	1,350
Cement and lime	260
Coal	156,663
Fertilizer	1,450
General merchandise	27,458

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1900—Continued.	Tons.
Granite.....	5, 073
Hay.....	453
Ice.....	438, 090
Iron.....	6, 864
Lumber and ship timbers.....	70, 881
Salt.....	1, 963
Sand.....	1, 900
Wood.....	4, 525
Total.....	716, 930

Arrivals and departures in calendar year 1900.

Foreign:	
Sailing vessels, average 100 tons each.....	6
Coastwise:	
Steamers, about 1,600 tons each.....	545
Steamers, about 100 tons and less each.....	585
Sailing vessels, average 400 tons each.....	2, 642
Tugs plying on the river.....	14
Ferryboats plying on the river.....	2
Vessels built during the year, 41,532 tons.....	35

A 12.

IMPROVEMENT OF PORTLAND HARBOR, MAINE.

The approved project and the report of progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1901, Part I, page 131.

The contract with Morris & Cumings Dredging Company was entered into July 13, 1900, and dredging was commenced August 30, 1900, with one dredge. A second dredge was put on January 3, 1901, and a third on January 7. On May 30, 1901, dredge No. 5, the largest and best of the three, took fire, and was scuttled to save her hull. She was raised June 19, and will resume work as soon as repairs are completed.

The work of the fiscal year by this company consisted in the removal of 821,900 cubic yards of material, situ measurement, being the equivalent of 1,031,476 cubic yards, scow measurement. The progress made has not averaged 120,000 cubic yards per month, as required by the contract, but it is confidently believed that the work will be completed within the time specified, viz, twenty-one months from date of beginning.

The total estimated quantity in the project is 4,318,910 cubic yards, situ measurement. The total excavated to date, comprising 1,813,409 cubic yards, by George M. Valentine & Co. and A. R. Wright, and 821,900 cubic yards by Morris & Cumings Dredging Company, is 2 635,309 cubic yards, leaving 1,683,601 cubic yards, situ, as the estimated quantity remaining to be dredged to complete the improvement as projected.

The chart herewith has been prepared to show graphically the area which has been dredged to June 30, 1901, and the areas which remain to be dredged in completion of the project.

The maximum draft that can be carried to the wharves in Back Cove is about 11 feet, and to the wharves in the lower part of Portland Harbor about 29 feet, at mean low water. The work remaining to be done

consists in extending the 30-foot dredging to the lines limiting the project.

The movements of the ocean steamers have been very much facilitated so far, and the arrivals and departures of these large steamers now are independent of the stages of the tide.

The expenditures during the fiscal year 1901 were \$96,964.84.

A preliminary examination and a survey of Witch Rock, located at the entrance of Portland Harbor, has been made in compliance with requirements of emergency river and harbor act of June 6, 1900. Reports thereon are published in H. Doc. No. 85, Fifty-sixth Congress, second session.

The harbor is defended by Forts Preble, Gorges, Scammel, Williams, Levett, and batteries on Great Diamond Island. There is a light-house on the breakwater, one on Spring Point Ledge, both in the harbor, and one at Portland Head, 3 miles distant from the city. The harbor is in the collection district of Portland and Falmouth, of which Portland is the port of entry.

Money statement.

July 1, 1900, balance unexpended.....	\$359,517. 41
Amount appropriated by sundry civil act approved March 3, 1901.....	21,000. 00
	380,517. 41
June 30, 1901, amount expended during fiscal year.....	96,964. 84
	July 1, 1901, balance unexpended..... 283,552. 57
July 1, 1901, outstanding liabilities.....	10,825. 88
	July 1, 1901, balance available..... 272,726. 69
	July 1, 1901, amount covered by uncompleted contracts..... 254,218. 78

APPROPRIATIONS.

July 4, 1836, for breakwater.....	\$10,000. 00
March 3, 1837, for breakwater.....	25,000. 00
July 7, 1838, for breakwater.....	26,366. 00
June 23, 1866, for extending breakwater, but unexpended balance made available for excavating middle ground by joint resolution of June 5, 1868.....	105,111. 05
July 11, 1870, for improving harbor.....	10,000. 00
March 3, 1871, for improving harbor.....	40,000. 00
June 10, 1872, for improving Portland Harbor and Back Bay.....	45,000. 00
March 3, 1873, for improving harbor.....	50,000. 00
June 23, 1874, for improving harbor.....	20,000. 00
March 3, 1875, for improving harbor.....	20,000. 00
March 3, 1881, for improving harbor.....	20,000. 00
August 2, 1882, for improving harbor.....	35,000. 00
July 5, 1884, for improving harbor.....	30,000. 00
August 5, 1886, for improving harbor.....	30,000. 00
August 5, 1886, for Back Cove.....	26,250. 00
August 11, 1888, for improving harbor.....	40,000. 00
August 11, 1888, for Back Cove.....	25,000. 00
September 19, 1890, for improving harbor.....	40,000. 00
September 19, 1890, for Back Cove.....	25,000. 00
July 13, 1892, for improving harbor.....	30,000. 00
July 13, 1892, for Back Cove.....	20,000. 00
August 18, 1894, for Back Cove.....	20,000. 00
June 3, 1896.....	20,000. 00
June 4, 1897.....	350,000. 00
July 1, 1898.....	200,000. 00
March 3, 1901.....	21,000. 00
Total.....	1,283,727. 05

1008 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Contract in force during fiscal year ending June 30, 1901.

Name of contractors: Morris & Cumings Dredging Company.

Date of contract: July 13, 1900.

Date of approval: August 13, 1900.

Time for commencement: October 14, 1900.

Time of completion: July 13, 1902.

Rate: For dredging, exclusive of 29-foot area, 13.85 cents per cubic yard; for dredging 29-foot area, 16½ cents per cubic yard.

COMMERCIAL STATISTICS.

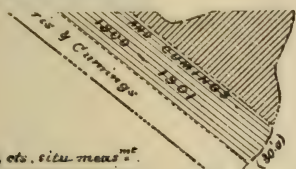
Receipts and shipments.

	Tons.
1891	1, 368, 237
1892	1, 376, 815
1893	1, 432, 805
1894	1, 214, 887
1895	1, 339, 064
1896	1, 357, 575
1897	1, 326, 844
1898	1, 334, 752
1899	1, 620, 284
1900:	
Apples and citrous fruits	28, 260
Asbestos	4, 000
Brick	303
Brimstone	11, 488
Burlap	1, 800
Canned goods and provisions	49, 068
Cattle on hoof	25, 340
Cement and clay, etc	80, 494
Coal	1, 090, 974
Cotton	14, 072
Fish, canned, pickled, smoked, and dry	37, 401
Flour, grain, hay, and feed	372, 871
General merchandise	315, 166
Iron, tin, and machinery	10, 912
Ice	1, 453
Leather and hides	5, 718
Lumber and cooperage	63, 303
Molasses and sugar	24, 354
Molding sand	4, 265
Oil, paints, etc.	31, 490
Printing paper	37, 250
Salt	3, 692
Sand	16, 586
Shooks, box	2, 000
Stone	25, 148
Turned wood	3, 600
Total	2, 261, 008

Arrivals and departures in calendar year 1900.

Steamers:

Foreign, tonnage 5,500 tons, draft 26 feet	42
Foreign, tonnage 3,400 tons, draft 24 feet	48
Foreign, tonnage 2,000 tons, draft 22 feet	46
Foreign, tonnage 1,800 tons, draft 18 feet	325
Foreign, tonnage 250 tons, draft 10 feet	5
Coastwise, tonnage 1,220 tons, draft 16 feet	753
Coastwise, tonnage 2,000 tons, draft 22 feet	12
Coastwise, tonnage 1,600 to 1,800 tons, draft 15 to 18 feet	275
Coastwise, tonnage 40 to 75 tons, draft 6 to 10 feet	10



$9\frac{24}{100}$ etc. situ meas^{me}

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Scale 1



Eng 57 1

PORTLAND HARBOR, MAINE.

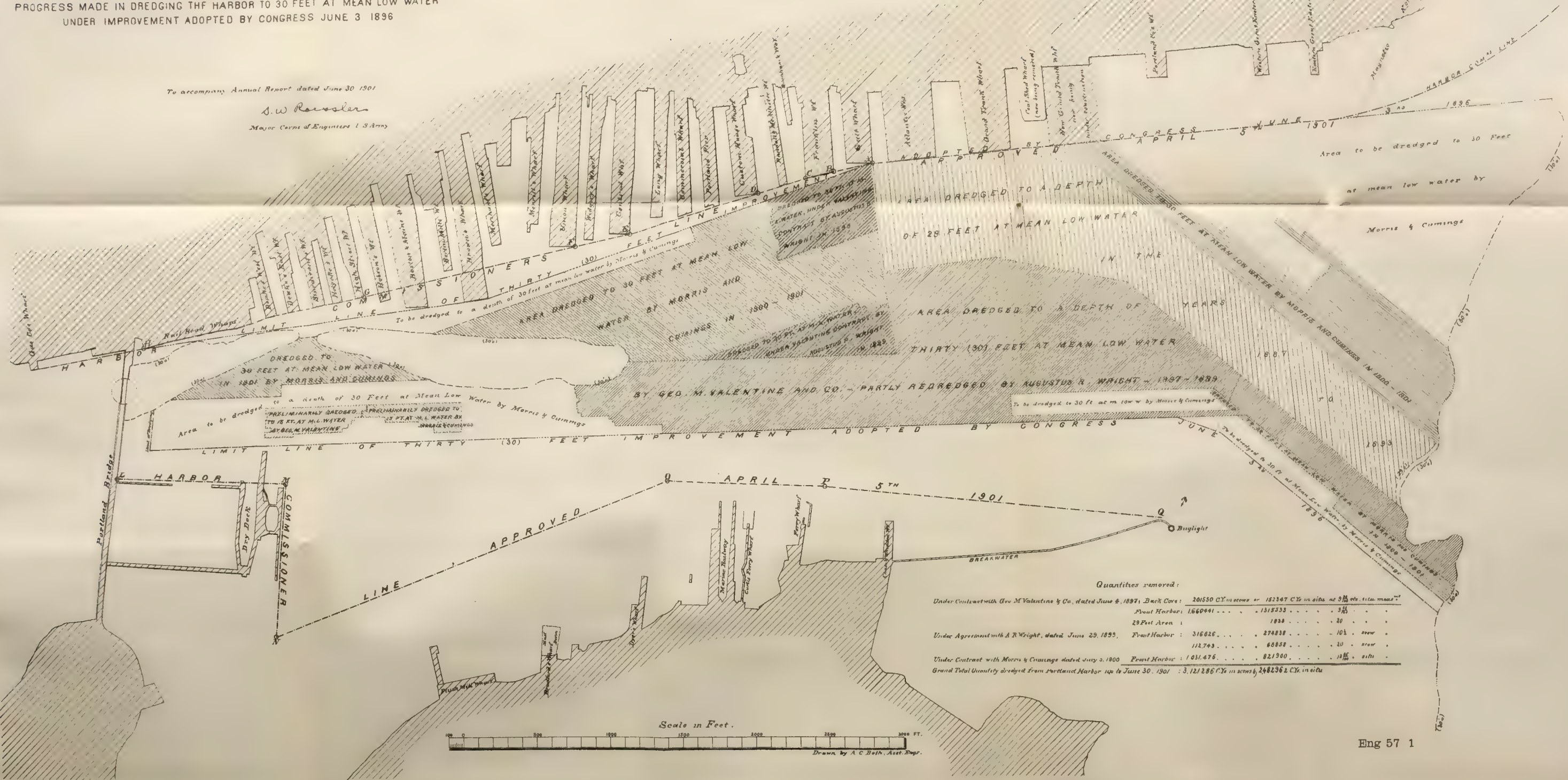
SKETCH SHOWING

PROGRESS MADE IN DREDGING THE HARBOR TO 30 FEET AT MEAN LOW WATER
UNDER IMPROVEMENT ADOPTED BY CONGRESS JUNE 3 1896

To accompany Annual Report dated June 30 1901

S. W. Russell

Major Corps of Engineers U. S. Army



Quantities removed:

Under Contract with Geo. M. Valentine & Co., dated June 6, 1897, Back Cove:	20550 CY in scows or 182367 CY in situ at 9 1/2 ft. mean water
Front Harbor:	1660441 1315333 3 1/2 . . .
29 Feet Area:	1838 20
Under Agreement with A. R. Wright, dated June 29, 1899, Front Harbor:	316626 274838 10 1/2 . . .
	112743 68858 20 . . .
Under Contract with Morris & Cummings dated July 3, 1900	Front Harbor: 1031476 821900 13 1/2 . . .
Grand Total Quantity dredged from Portland Harbor up to June 30, 1901:	3,121,286 CY in scows & 248,236 CY in situ

Sailing vessels:

Foreign, tonnage 436 tons, draft 16 feet.....	102
Foreign, tonnage less than 100 tons, draft less than 10 feet.....	200
Foreign, tonnage over 100 tons, draft over 10 feet.....	65
Barges, tonnage 650 tons, draft 17 feet.....	5
Steam tugs.....	3
Coastwise, tonnage 353 tons, average draft 12 feet.....	49
Coastwise, tonnage 2,500 tons, draft 24 feet.....	50
Coastwise, tonnage 1,500 tons, average draft 19 feet.....	53
Coastwise, tonnage 600 to 800 tons, average draft 15 to 18 feet.....	58
Coastwise, tonnage 1,200 to 1,500 tons, draft 15 feet.....	391
Coastwise, tonnage 50 to 75 tons, draft 6 to 8 feet.....	2, 736
Coastwise, tonnage over 100 tons, draft over 10 feet.....	538
Steam tugs.....	419
Barges, tonnage 1,650 tons, draft 17 feet.....	75

The above does not include large fleets of vessels arriving for refuge only.

A 13.

EXAMINATION AND SURVEY OF PORTLAND HARBOR, MAINE.

[Printed in House Doc. No. 85, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 26, 1900.

SIR: I have the honor to submit herewith copies of reports dated October 18 and November 17, 1900, by Maj. S. W. Roessler, Corps of Engineers, upon preliminary examination and survey, respectively, of Portland Harbor, Maine, with a view to removing so much of Witch Rock as endangers navigation, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

A plan for removing the rock to a depth of 36 feet at mean low water, at an estimated cost of \$500,000, is presented by Major Roessler, who states in his report on preliminary examination that the locality is worthy of improvement by the General Government to this extent, in which view the division engineer, Col. G. L. Gillespie, Corps of Engineers, concurs. In his report on survey, however, Major Roessler states that—

Upon further reflection and in view of the great cost of the work, I think it would be best to first consider the question of establishing on this rock a light and fog signal of high efficiency to meet the needs of navigation in all kinds of weather and to postpone consideration of its removal as a last resort, in case no suitable signals should be found practicable without the erection of an expensive light-house.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF PORTLAND HARBOR, MAINE, WITH A VIEW TO REMOVING SO MUCH OF WITCH ROCK AS ENDANGERS NAVIGATION.

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 18, 1900.

GENERAL: The following report of a preliminary examination of "Portland Harbor, with a view to removing so much of Witch Rock as endangers navigation," is submitted in compliance with act of Congress approved June 6, 1900.

PORTLAND HARBOR AS A HARBOR OF COMMERCE.

Portland is the principal railway center and port of commerce on the coast of New England north and east of the city of Boston.

By rail it has connections with the State of Maine north and east over the main line of the Maine Central Railroad and connecting roads; with Montreal, central and western Canada, over the Grand Trunk system; with Montreal, Quebec, and with the west via Lake Champlain and Buffalo, over the Mountain Division of the Maine Central; and with the south and west over the Boston and Maine Railroad system. All roads are large distributors of coal and other supplies received by vessel at the port of Portland, and the Maine Central and Grand Trunk are great feeders to the export trade from Portland, coastwise and foreign, the former bringing supplies of lumber, the latter large shipments of grain, cattle, hay, and other farm produce, from Canada for export to England and the Continent.

By sea it has a triweekly steamship to New York City; a daily boat to Boston; a triweekly packet to Rockland and intermediate points; a semiweekly packet via Rockland and intermediate points to Machias nine months of each year; a triweekly packet in summer, and weekly steamship in winter to St. John, Eastport, and Boston. The number of arrivals and departures of coastwise steamers during the calendar year 1899, including vessels seeking refuge, was 2,382. Of these 17 had a draft of 21 feet and 208 a draft of 20 feet. The number of arrivals and departures of foreign steamers during the same period was 296; most of these came in light and went out loaded, drawing from 26 to 29.7 feet.

Portland's coastwise trade in sailing vessels, consisting principally of coal and lumber, is large. During the calendar year 1899 the number of arrivals and departures of coastwise vessels, including boats seeking refuge, was 2,747, of which the largest were 4 and 5 masted schooners bringing in coal, and drawing from 23.5 to 25.5 feet of water. The number of arrivals and departures of foreign sailing vessels during the same period was 319. How many of the arrivals and departures were vessels doing business at the port and how many were vessels seeking shelter is not known. It may be safely said, however, that the number of steamers using the harbor for refuge is small and the number of sailing vessels large. According to the records kept by the harbor master, it would appear that about 50 steamers and 1,200 sailing vessels came into the harbor for refuge during the year 1898.

From its advantageous geographical location and nearness to Canada's commercial metropolis, as compared with St. John and Halifax, Portland is admitted to be the best harbor on the Atlantic seaboard for

receiving and shipping Canadian exports during the season from November to April, when the St. Lawrence River is closed by ice. Recognizing this, the Grand Trunk Railway of Canada have made it the Atlantic terminus of its large transportation system, and have erected extensive elevators and dock facilities for handling its large export trade during the winter season. This trade is of great benefit to the commercial interests of Portland, and promises to increase under the same advantages of location and harbor facilities which have given Portland Harbor its present high position as compared with its rival ports of St. John and Halifax as a place for exporting Canadian products.

Of the 297 arrivals and departures of foreign steamships during the calendar year 1899 the great majority were vessels engaged in the above export trade, coming in light and going out loaded, the larger ones drawing from 26 to 29.7 feet of water with full cargoes. It was mainly to accommodate this increasing export trade, as well as the increasing coastwise traffic in schooners of great draft, that Congress, after appropriating small sums from time to time since 1868 in deepening the inner harbor in the vicinity of the wharves, adopted, by the act of June 3, 1896, a comprehensive plan for dredging the harbor to a depth of 30 feet at mean low water, at a cost not to exceed \$810,000, and made provision for the execution of the work under a continuous contract.

The total receipts and shipments for the fiscal year ending June 30, 1899, as stated in the last annual report, were 1,620,284 tons, being an increase of 285,522 tons over the shipments and receipts of the preceding year. Of this, 669,045 tons were coal, carried for the most part in large schooners of deep draft, the largest drawing from 23.5 to 25.5 feet.

PORTLAND HARBOR AS A HARBOR OF REFUGE.

The importance of Portland Harbor as a harbor of refuge can not be overstated. The natural advantages of a deep entrance, ample anchorage room, and good holding ground, give this port a preeminent position among the harbors of northeastern New England as a place of refuge for the large number of vessels that navigate this stormy and rock-bound coast. The extent of its use as such may be inferred from the fact that during the calendar year 1898, according to the estimate of the harbor master, 50 steamers and 1,200 sailing vessels used the harbor as a harbor of refuge.

The first harbor of refuge south of Portland, when completed, will be Cape Porpoise, about 30 miles distant, but its depth of 15 feet will admit only a smaller class of vessels. The first important harbor to the south is Portsmouth, 58 miles distant, and beyond that Cape Ann, about 83 miles distant. Going east, the first haven is Boothbay Harbor, with its limited anchorage area, about 35 miles distant, and beyond that Rockland Harbor, about 75 miles from Portland.

In time of war Portland Harbor, as the only first-class fortified point on our coast north and east of Boston, would be of the highest importance to the Navy as a base from which to carry on aggressive operations at sea and as a point to which its vessels after reverse in battle could safely retire under the protection of the land forts.

OBSTRUCTIONS AT ENTRANCE TO PORTLAND HARBOR.

The main ship channel to Portland Harbor is the deep-water entrance between Cushing Island on the east and the main shore at Portland Head on the west. It lies at the apex of a reentering angle whose western limit is a line from Portland Head to the promontory of Cape Elizabeth to the south, and whose northerly limit is a line from Portland Head in the direction of Halfway Rock light and Seguin Island light toward the east. Within this angle is included a number of rocky shoals and reefs which constitute the chief dangers to the navigation of Portland Harbor.

In approaching the entrance the first obstruction met with is a group of rocky reefs called West Cod Ledge, about 5 nautical miles off Portland Head. These shoals are distributed along a line about $5\frac{1}{4}$ miles in length and nearly perpendicular to the axes of the angle of approach. Beginning with the most westerly one, these shoals are as follows: Old Anthony, with a depth of $3\frac{1}{4}$ fathoms; Aldens and Corwin Rocks, with 6 feet and $3\frac{1}{2}$ fathoms, respectively; West Cod Ledge, $4\frac{1}{2}$ fathoms; Bache Rock, $4\frac{1}{2}$ fathoms; Bulwark Shoal, 14 feet. East of Bulwark Shoal is East Cod Ledge, with a minimum depth of $4\frac{3}{4}$ fathoms, and south of Aldens Rocks are East Hue and Cry Rocks, with $3\frac{1}{4}$ fathoms.

Between these reefs are passages with ample depth of water for use by the largest vessels, but they are too distant from the lights and fog signals to make them safe for navigation except by day in clear weather. At night or in foggy weather there are only two reasonably safe avenues of approach past this group of ledges by deep-draft vessels—one via the whistling buoy off Halfway Rock to the east of West Cod Ledge, the other via the whistling buoy off Old Anthony Rock and Cape Elizabeth lights. All coastwise steamers bound south and west habitually use the western passage past Cape Elizabeth, and all east-bound traffic and foreign-bound steamships use the easterly route via Halfway Rock light.

After passing this outer line of obstructions, other rock shoals endanger more or less the nearer approach to the entrance off Portland Head light. On the western passage, after passing Old Anthony whistling buoy, coming into port, are Taylors Reef, Broad Cove Rock, and Willard Rock on the port side and Jordans Reef on the starboard side, but vessels navigating this route are not of the greatest draft, and pilots go over it so frequently that no special difficulty is experienced by them in safely tracing their course in all kinds of weather.

The easterly approach to the entrance at Portland Head is obstructed and endangered by Ram Island Ledge on the starboard side, Jordans Reef on the port side, and especially by Witch Rock, whose location on a line perpendicular to the direction of approach is between the two and about one-third their distance apart from Jordans Reef. As located on Coast Survey charts, their magnetic bearings and distances from Portland Head light are as follows: Ram Island Ledge E. by N. $\frac{1}{2}$ N., distant 2,000 yards; Jordans Reef ESE. $\frac{1}{2}$ S., 2,000 yards; Witch Rock E. by S. 3,000 yards.

Steering on a straight course from the whistling buoy at Halfway Rock light toward Portland Head light, with accurate compass and no wind and tide, would leave Ram Island Ledge 600 yards on one side, Jordans Reef 600 yards and Witch Rock 300 yards on the other side.

Vessels are therefore obliged to proceed cautiously until Witch Rock buoy is sighted or passed, and a course that would give this obstruction a comfortable berth would, if prolonged, bring them within dangerous proximity to Ram Island Ledge on one side or Jordans Reef on the other. These last are dangerous mainly because of the presence of Witch Rock between them, and would largely disappear as such so far as the eastern passage is concerned were Witch Rock removed to a safe depth.

While thus shown to be a great danger to incoming vessels, Witch Rock is regarded no less so by outgoing vessels of deep draft. On February 25, 1900, the steamship *Californian*, deeply loaded for England, proceeded to sea at night and ran upon Ram Island Ledge, becoming nearly a total wreck. Though afterwards floated, she was found to be too badly damaged to be repaired. In the investigation which followed, as I recall it, it was shown that the accident was due to errors which were avoidable, but which were attributable in part to the captain's fear of Witch Rock, which he wished to leave on the starboard side. It is safe to say that but for the existence of this obstacle a course would have been taken which, despite an error in giving out the course to the officer on the bridge and a strong tide and wind from the south to north, would have carried the steamer a safe distance from Ram Island Ledge. In blinding snowstorms and dense fogs the following method of piloting vessels to sea has been used by one of the most experienced pilots of the harbor: With the vessel abreast of Spring Point light (Fort Preble) within the harbor, the pilot, who remains on board a tug, proceeds to the bell buoy off the point of Cushing Island; when the buoy is found, the tug takes station there and signals to the vessel, which then steams slowly in the direction of the tug's whistle; arriving at the tug's station, the vessel checks her speed while the tug proceeds to find Witch Rock buoy; this found, signals are given and the vessel proceeds as before. This method of procedure is not without its risks. Its safety depends entirely upon the success of the tug in quickly finding the buoys. Any accident to the tug, or considerable delay in taking her station, would endanger her convoy, which meanwhile would be liable to drift under adverse wind and tide into a dangerous position. With Witch Rock removed to a safe depth such a procedure would not be necessary. Vessels could then proceed off Portland Head light, and with that signal astern could steer a straight course to sea with the assurance of passing Ram Island Ledge and Jordans Reef at a safe and comfortable distance.

The foregoing illustrates how greatly the navigation of Portland Harbor would be benefited by the proposed improvement. I have, however, been unwilling to express an opinion upon the merits of the work until its feasibility could be shown by a survey and an approximate estimate of the quantity of ledge to be removed. This survey was commenced in August, under the immediate direction of Assistant Engineer F. S. Burrowes. As the survey required smooth sea and clear weather, it has suffered many interruptions on account of unfavorable seas and weather, and was completed October 15. It has been made with care, and when completed and checked will afford an accurate estimate of the quantity of ledge in the shoal. The hydrographic work has been supplemented by an examination by a diver, and samples of the rock have been obtained.

The depth to which the rock should be removed, if taken out at all, has received careful consideration. It has been taken at 36 feet at mean low water. The area of the shoal at this depth is about 400 feet by 200 feet, and the approximate quantity above that plane 20,000 cubic yards. The highest point is 23.5 feet below mean low water. At \$25 per cubic yard, situ measurement, the estimated cost of the work is \$500,000. This estimate is subject to revision when the survey has been checked.

The question of marking the position of the rock more efficiently than it is now has been considered, but it is the consensus of opinion that the removal of the rock to a safe depth is the only means of making the easterly entrance safe in all kinds of weather.

In view of the above facts, giving consideration not only to the commerce of the harbor, but to the position of the port as a fortified place of the first class and to the need of a safe entrance for the vessels of the Navy, I am of the opinion that the proposed improvement, notwithstanding its high cost, is a work worthy of being done by the General Government to the extent indicated.

The maps which are to accompany this report, with a report on the survey by Mr. Burrowes, will be completed and forwarded at the earliest practicable date.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, October 19, 1900.

Respectfully forwarded to the Chief of Engineers, concurring in the views of the district officer.

The larger vessels which use this port are said to load to 30 feet. It will not be wise, therefore, to begin upon so important an improvement except under a project which contemplates the removal of the rock to the plane of 36 feet below mean low water. It is probable that a contract may be made for a less price than \$25 per cubic yard.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 24, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Portland Harbor, Maine, with a view to removing so much of Witch Rock as endangers navigation, required by emergency river and harbor act of June 6, 1900.

Major Roessler considers the locality worthy of improvement by

the United States to the extent of removing the rock to a depth of 36 feet at mean low water, and his views are concurred in by the division engineer and by me.

I recommend that the preparation of a plan and estimate of cost of improvement be authorized.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
October 24, 1900.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN C. SCOFIELD,
Chief Clerk.

SURVEY OF PORTLAND HARBOR, MAINE, WITH A VIEW TO REMOVING
SO MUCH OF WITCH ROCK AS ENDANGERS NAVIGATION.

UNITED STATES ENGINEER OFFICE,
Portland, Me., November 17, 1900.

GENERAL: Complying with Department letter of October 26, 1900, I have the honor to submit the following report of a survey of Witch Rock, Portland Harbor, Maine, made under the provisions of the emergency river and harbor act of June 6, 1900, with a view to the removal of so much of it as endangers navigation.

The survey included a carefully made set of soundings over the rock and an examination by a diver. It was in the immediate charge of Mr. F. S. Burrowes, assistant engineer, whose report is herewith. The methods of making the survey are fully described in his report. They were such as to insure accuracy in the location of the soundings, in the reduction of soundings to mean low water, and to afford a correct delineation of the rock and a reliable estimate of its contents. This survey was made in August and was followed in October, as weather permitted, by the diver's examination.

One tracing,¹ showing the rock plotted to a scale of 1:600, and a general plan of Portland Harbor and approaches, as taken from Coast Survey Chart No. 106, plotted to a scale of 1:80,000, is herewith.

The depth to which the rock should be removed, if removed at all, has received careful consideration, and it is thought should not be less than 36 feet below the level of mean low tide. This depth has been taken because the dredging now in progress in the inner harbor, under the plan adopted by Congress in 1896, provides for a depth of 30 feet at mean low water, and because a vessel utilizing this full depth in the still water of the harbor would require at least 6 feet greater depth in the seas likely to be encountered in ordinary gales in the vicinity of Witch rock.

The rock is not a pinnacle, as was supposed by many, but a gradual

¹ Not printed.

rock shoal, oval in plan, with its longest diameter parallel to the adjacent ledges and islands. The area of the rock at a depth of 36 feet below mean low tide is 109,250 square feet, and the average depth of the rock above this plane is about 5 feet and the contents 20,230 cubic yards. The highest point of the rock is 23.4 feet below mean low tide.

The diver's examination showed the surface to be very uneven, perpendicular faces 4 to 5 feet high being not uncommon. A small blast was made at this time and samples of the rock obtained. From these it would appear that it is an amorphous rock granitic in character, similar to ledges which crop out above low tide in the near vicinity. It would probably not be difficult to do a portion of the blasting by charges judiciously placed in crevices of the rock.

The probable cost of removal has been difficult to estimate, there being no precedent, so far as I know, for like work on this portion of the coast. The locality is exposed to the full force of the sea, and in naming prices bidders would probably make due allowance for a season of unusually bad weather and possible loss of plant. The probable cost has been taken at \$25 per cubic yard, or about two and one-half times as great as the same class of rock could probably be done for in a place sheltered from the sea. At this price the cost of removal, including engineering expenses, would be \$505,750, or in round numbers \$500,000.

In the preliminary report the opinion was expressed that the locality was worthy of improvement to the extent of removing the rock to a depth of 36 feet at mean low water. Upon further reflection, and in view of the great cost of the work, I think it would be best to first consider the question of establishing on this rock a light and fog signal of high efficiency to meet the needs of navigation in all kinds of weather, and to postpone consideration of its removal as a last resort in case no suitable signals should be found practicable without the erection of an expensive light-house.

For the facts and reasons upon which my recommendation is based, attention is respectfully invited to my preliminary report of October 18, 1900, in which is given a full description of the manner in which the entrance is navigated by the deeper class of vessels, the extent to which Witch Rock endangers this navigation, together with a statement of the commerce and other interests that would be benefited by a removal of the rock, or by the erection thereon of an efficient light and fog signal.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. F. S. BURROWES, ASSISTANT ENGINEER.

PORTLAND, ME., November 13, 1900.

MAJOR: I have the honor to submit the following report of a survey of Witch Rock, at the entrance to Portland Harbor, Maine, made under your direction, in compliance with requirements of emergency river and harbor act of June 6, 1900.

The survey proper—that is, the location of the rock and taking necessary sound-

ings—was made during the month of August. A part of these soundings were then plotted on a comparatively small scale and the quantity of ledge to be removed above a plane 36 feet below mean low tide was roughly calculated as 20,000 cubic yards measured in place. This approximate amount was for use in your preliminary report only. A subsequent calculation made from a more careful plotting of the rock on a much larger scale shows this true amount to be 20,230 cubic yards.

The method of making the survey was as follows: A base line 1,323.27 feet long was carefully measured on Ram Island, and from this, by a system of triangles, a calculated base 8,325.57 feet long was obtained for locating soundings. This base extended from a copper bolt (C. 1), set in the parapet of one of the batteries at Fort Williams (Portland Head) to a drill-hole in ledge (Δ E. B.) on the easterly end of Ram Island. A system of diverging ranges which crossed Witch Rock at intervals of about 7 feet was laid out from this easterly end of the base line on Ram Island and points to mark the ranges were set on the easterly end of Cushing Island. The soundings were taken from a small boat rowed slowly along each of the ranges, as described, the boat being kept on line by means of a tall signal placed at (Δ E. B.) on Ram Island and a small signal pole which was shifted from point to point on Cushing Island by a man placed there for that purpose. The distances being great—that is, about 6,000 feet from the rock to the first range on Ram Island—and about 3,000 feet farther to the back ranges on Cushing Island, it was found difficult at times to clearly discern the back ranges. An ordinary hand mirror used by the man at the back ranges to show flashes directly over the front range was found to give excellent results, so that the boat could at all times be kept on line. These soundings were taken with an ordinary lead and line, the boat being brought to a standstill for each sounding and a plumb depth measured. The positions along the ranges were located by an observer with a transit on the parapet at Fort Williams, a sight and angular measurement being taken to the sounding line at each sounding. The average intersection angle between the ranges and the lines of sight from the transit was about 61° . The time of each sounding was noted by the recorder in the boat and the depths afterwards reduced to the plane of mean low tide by comparison with the records kept continuously by an observer at a tide gauge on Cushing Island.

The surface of the ledge was found by the sounding lead to be very rough and abrupt, considerable changes in depth being frequently observed.

An examination was made in October by means of a diver. This examination covered nearly the entire area of the rock and also showed the surface to be very uneven, perpendicular faces 4 or 5 feet high being not uncommon. A small blast was made at this time and a number of samples taken up. From these it would appear that the rock is very similar in character to ledges which crop up above low tide in the immediate vicinity; that is, an amorphous rock, granitic in character, which has probably been forced up through a stratified rock. It would probably be not difficult to drill and much might be accomplished by firing the explosives previously placed in convenient crevices without drilling. The rock is not a pinnacle, as many have previously supposed, but an ordinary rock shoal oval in plan and with its longest diameter parallel to the adjacent ledges and islands. There is very little sand on the rock, even in the crevices, and it may be regarded as practically bare ledge. The area at a depth of 36 feet at mean low tide is about 109,250 square feet, and the average cut to this depth will be about 5 feet.

The highest point of the rock is 23.4 feet below mean low tide, and bears N. $87^{\circ} 15'$ E. (true), 8,550 feet from Portland Head light.

One tracing showing the rock plotted to a scale of 1 to 600, with a part of the soundings taken during the survey indicated thereon, and a general plan of Portland Harbor and approaches, as taken from coast chart No. 106 and plotted to a scale of 1 to 80,000, is submitted herewith.

In your preliminary report you have shown conclusively the importance of Portland Harbor for purposes of commerce, as a refuge, and as a strategic point in time of war. Your report and a glance at the map also show that the only safe entrance for vessels drawing from 20 to 30 feet at all stages of the tide and in all kinds of weather is from the eastward; that is, in the sector with Portland Head light as the center of the circle and radial bounding lines running to Halfway Rock light on the north and the easterly end of Cod Ledges to the southward. Throughout this sector there is sufficient depth of water for the largest vessels except over Witch Rock, which unfortunately lies almost directly in the line bisecting this sector.

As stated in your preliminary report, large vessels when entering Portland Harbor in thick weather try to pick up the whistling buoy off Halfway Rock, and thence shape their course by compass for Portland Head light. This would carry the vessel between Witch Rock and Ram Island ledges, but so close to the former as not to leave much allowance for leeway or inaccuracy of the compass. The red can buoy

which marks Witch Rock is so placed as would seem to indicate that it should be left on the starboard hand and entrance made through the narrower passage between Witch Rock and Jordans Reef. In any event, Witch Rock is a serious menace to deep-draft vessels either in entering or leaving the harbor in bad weather, and should either be removed or some sort of light and fog signal placed on it so that its position could be accurately located from a safe distance at all times.

In estimating for its removal a depth of 36 feet at mean low tide has been assumed, principally for the reason that a depth of 30 feet is being obtained by dredging throughout the inner harbor, and vessels loaded to utilize this depth in the comparatively smooth waters of the harbor would require at least 6 feet greater depth of water in the heavy seas likely to be encountered in the vicinity of Witch Rock.

The estimate of the amount of material to be removed has been made with care, and considering the irregularities of the surface of the rock is believed to be fair and even liberal.

The price for the removal of rock has been difficult to fix with accuracy. The same rock, if protected from heavy seas, could be removed for less than \$10 per cubic yard. This rock, however, is in the open sea, and factors are thereby introduced for which no definite and equitable allowance can be made, such as a season of very bad weather, with consequent great loss of time and possibly loss of plant. Bidders will of course take these facts into consideration, and will probably err on the side of safety for themselves in making up their bids.

Taking these facts into consideration, and the additional fact that the work is large, it is thought that \$25 per cubic yard, measured in place, should be ample to cover the cost of the work, including contingencies.

The estimate would, therefore, be as follows:

Estimate.

Removing 20,230 cubic yards of ledge, in situ, at \$25 per cubic yard, including all contingencies.....	\$505, 750
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Very respectfully, your obedient servant,

F. S. BURROWES,
Assistant Engineer.

Maj. S. W. ROESSLER,
Corps of Engineers, U. S. A.

A 14.

MODIFICATION OF HARBOR LINES AT LUBEC HARBOR, MAINE.

LUBEC BOARD OF TRADE,
Lubec, Me., March 8, 1901.

DEAR SIR: In 1891 the United States engineer laid out a harbor in Lubec Narrows; at that time the shore on that part of the town was not considered of much importance, but at this time the town is taking on renewed activity and this shore is rapidly building up.

The harbor line was run mostly above mean low water and is now an obstacle in our progress that is serious, especially in the case of one large plant to be built on Leadurny Point. Work on this plant (to employ some 200 people) has been started, but now find that they can not get the desired water without going beyond the "line," which has been drawn in at a point near Ryarson's wharf, throwing it above low-water mark (see chart¹ approved March 6, 1891). Upon investigation I find this was done through influence of some people for mercenary purposes, which I can fully explain to you.

Now I most earnestly ask you to straighten this line from the 100-foot point off Gun Rock to the point 247 feet from west base on

¹ Not printed.

Leadurny Point. If it should require considerable time to do this, will you not grant me a permit to extend a wharf 200 feet wide to extreme low-water mark at a point where the straight extensions of harbor line (see chart) strike Leadurny Point at Mowry's farm and situated on land leased by C. H. Clark from Samuel Mowry's estate.

I do wish you would be able to come right down and see for yourself, as I know you would be satisfied; if not, I would appreciate an early permit.

My interest in Lubec and all United States Government affairs pertaining to it are sincere, and I would not think of asking for anything that was not mutual benefit.

I wish you would step into the rooms of the Portland Board of Trade and make inquiry of Secretary Rich in reference to me, and if this letter should have to be forwarded to Washington, kindly have my friend Senator Frye called in.

No greater favor could be granted me or none more appreciated than to have you use your earliest convenience.

I am, yours, most respectfully,

CLARENCE H. CLARK.

Major ROESSLER, *U. S. Engineer.*

[Fourth indorsement.]

U. S. ENGINEER OFFICE,
Portland, Me., March 30, 1901.

Respectfully returned to the Chief of Engineers, United States Army, with report of this date.

S. W. ROESSLER,
Major, Corps of Engineers.

(Through the Division Engineer.)

[Fifth indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, April 3, 1901.

Respectfully returned to the Chief of Engineers, concurring in the views expressed in the report of the district officer.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 5, 1901.

Respectfully submitted to the Secretary of War.

Application having been made for a change in the established harbor line at Lubec, Me., the district engineer officer visited the locality, held a public hearing, due notice of which was given to the interested parties, and after careful consideration submits the accompanying report, dated the 30th ultimo, in which he recommends that the line be modified as described therein and indicated on the accompanying tracing.¹

¹ Not printed.

The modified line appears to be generally satisfactory to the interested parties, and I recommend its approval, and that the Secretary place his approval on the tracing which has been prepared for his signature.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of April 6, 1901, the approval being indicated on the map.

REPORT OF MAJ. S. W. ROESSLER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., March 30, 1901.

GENERAL: The public hearing authorized by the Department's indorsement of March 13, 1901, in the matter of a proposed change in the harbor line at Lubec, Me., suggested by Mr. C. H. Clark, of that place, was held at Lubec, Me., at 1.30 p. m. March 27, 1901, in the office of Mr. C. H. Clark, due notice thereof having been previously published in the nearest local newspaper, and parties most interested in the proposed change having been personally notified by the chairman of the board of selectmen, Mr. R. J. Peacock.

There were present at this hearing—

Mr. R. J. Peacock, selectman and wharf owner.
Mr. G. A. Mowry, wharf owner.
Mr. S. C. Pike, wharf owner.
Mr. B. M. Pike, wharf owner.
Mr. C. H. Clark, wharf owner.
Capt. S. F. Pike, representing International Steamship Company.
Mr. W. B. Mowry, wharf owner.
Col. A. B. Sumner, wharf owner.
Mr. T. M. Tucker, wharf owner.
Mr. G. G. Tucker, wharf owner.
Mr. E. L. King, local agent International Steamship Company.
Mr. H. E. Saunders, attorney, representing Kelley's wharf.

The letter of March 8 from Mr. C. H. Clark, with indorsements thereon, was read. A blue print of the harbor was exhibited and attention invited to the harbor line as approved by the Secretary of War March 6, 1891; to the fact that the harbor line consisted of two straight elements making a slight reentrant angle near the middle of the harbor; and that the proposition of Mr. C. H. Clark was to remove this reentrant angle by making the harbor line a straight line from the upper end to the lower end of the portion of the harbor in question. Mr. Clark stated that since writing his letter of March 8, and after conferring with other people interested in the subject, he desired to withdraw his first suggestion and to substitute therefor a recommendation that the present harbor line in the upper half of the harbor be not disturbed, but that the lower half of the line be set out 25 feet farther toward the navigable channel.

Referring to the accompanying tracing, the line proposed is the line

B-E, parallel with and 25 feet in advance of the old harbor line C-D. A general discussion of Mr. Clark's suggestion followed.

All were of the opinion that the proposed change would be of considerable value to the wharf owners in rear of it, by permitting them to extend their wharves to the vicinity of the low-water contour and therefore to a point where the boats could arrive at and depart from the wharves at a lower stage of the tide than is now possible. Attention was invited to the fact that the present harbor line does not permit them to extend their wharves to mean low water. Captain Pike, of the International Steamship Company, thought that the harbor line might be advanced in this portion of the harbor without interfering in any way with navigation.

The only objection made to the proposed new line was raised by Mr. Saunders, representing the Kelley wharf, because in 1890, at the public hearing when the present harbor line was established, Mr. Kelley was not permitted to extend his wharf at the upper end of the harbor as far as he desired, and therefore he did not see any reason why wharf owners at the lower portion of the harbor should be permitted a privilege that was not granted to the wharf owners in the upper end of the harbor; that it seemed to him a discrimination in favor of one portion as against another portion of the harbor. Mr. Peacock stated, in rejoinder, that the line of 1891 allowed Mr. Kelley to extend his wharf, which is at the upper end of the harbor, to a point where the water has a depth of about 3 feet at mean low tide, while at the southern end the line there established did not allow the wharves to extend even to the low-water contour, and that the line now proposed at the lower end of the harbor did not permit the wharves to be extended into as deep water as already existed at the end of Kelley's wharf. It was suggested to Mr. Saunders that if he desired a like extension of the line in the upper end of the harbor he should make a request to that effect and the matter would be discussed at the hearing, which request he then made. The consensus of opinion was that there should be no advance of the line in this vicinity because of the existence of a violent eddy which at ebb tide set up under Gun Rock, and because of the difficulty of avoiding collisions with the ends of the wharves in the positions they now are. Captain Pike was of the opinion that the channel in this portion of the harbor should not be further contracted. It was stated by several that collisions with the ends of Kelley's wharves had been known to occur, and that on one occasion the wharf was badly injured. There being very strong objections to any advance of the harbor line in this portion of the harbor, Mr. Saunders was informed that his request would not be recommended, and, if he desired, that he might file his objections in writing and that his letter would be forwarded to the Secretary of War, but no report has been received to date.

It was then suggested that the proposed new line B-E be extended 300 feet farther downstream to the point F, so as to permit the erection of wharves already planned south of Leadurny Point. To this there was no objection.

Referring to the accompanying tracing,¹ it is respectfully recommended that the request for a change in the harbor line in the lower portion of the harbor by setting it out 25 feet be granted, and that the new harbor line be as follows: Beginning at the point A, 100 feet out

¹ Not printed.

from the apex of Gun Rock, to continue along the harbor line of 1891 to the point B; thence continue in a straight line to the point E, 25 feet outside of the line C-D, and thence 300 feet farther to the point F.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

A 15.

ESTABLISHMENT OF HARBOR LINES IN PENOBSCOT RIVER AT
BANGOR, MAINE.

UNITED STATES ENGINEER OFFICE,
Portland, Me., June 16, 1900.

GENERAL: I have the honor to inclose herewith:

1. Letter¹ of June 15, 1900, from Mr. George F. Evans, vice-president and general manager of the Maine Central Railroad Company, requesting a modification in the present harbor line along a portion of the harbor at Bangor, Me., as indicated in his letter and as shown on the blue print,¹ three copies accompanying his letter.

2. Certificate¹ of approval of the proposed changes by the mayor and aldermen of Bangor, who, under State law, are the local municipal officers having supervision over such questions.

3. Copy of resolutions¹ of the Board of Trade of the city of Bangor, unanimously approving the desired changes.

4. Copy of letter¹ from the harbor master at Bangor, stating that the changes will not improperly or inconveniently restrict the anchorage room of the harbor and recommending their adoption.

The present harbor line was established in November, 1877, and terminates at the downstream end at the point marked XII on the blue print. The change desired in this line is that included between points marked II and V, the new line recommended being that indicated as "the suggested harbor line." Between the points V and XII there is no change. Below XII there is at present no harbor line. The line suggested below this point is that indicated by the broken and dotted line D, E, F, G, and H, terminating at a point opposite the boundary line of the property controlled by the Maine Central Railroad Company. The last portion of this line, namely, G H, is given such direction that its prolongation will coincide with the end of the most advanced wharf of the property abutting that of the railroad company. The desired change in the old harbor line is in the direction of a logical rectification of the harbor line in this vicinity and is recommended. The desired new harbor line below the terminus of the present one is the logical one for this locality and is also recommended.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 19, 1900.

Respectfully forwarded to the Chief of Engineers.

I see no objection to the harbor lines proposed to be established on the Bangor side, but it is desirable that similar lines should also be established simultaneously on the east or Brewer side. It is to be noted that the lines now established are State lines, no Government lines having been established or applied for under the act of 1888. It is recommended that the district officer be requested, after a public hearing has been held, to submit for the approval of the Secretary of War a system of harbor lines for this harbor, in conformity with section 11, river and harbor act of March 3, 1899.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 25, 1900.

Respectfully returned to Major Roessler, attention being invited to the views of the division engineer in first indorsement hereon, which are concurred in by this office.

The map showing the harbor lines recommended for adoption should be in the form of a tracing.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieutenant-Colonel, Corps of Engineers.

[Third indorsement.]

UNITED STATES ENGINEER OFFICE,
Portland, Me., February 5, 1901.

Respectfully forwarded to the Chief of Engineers, United States Army, with report of this date. The blue prints have been retained in this office.

S. W. ROESSLER,
Major, Corps of Engineers.

[Fourth indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, February 8, 1901.

Respectfully forwarded to the Chief of Engineers, concurring in the views and recommendations of the district officer.

The harbor lines as recommended seem to subserve satisfactorily the commercial interests of the port. The two piers on the east side, owned by the American Ice Company, project unreasonably into the channel, but I concur with the district officer that it is inexpedient to direct their removal at the present time. At the time their renewal becomes necessary, the channel depth may be so increased that the length of the piers may be shortened without injury to the owners.

It is recommended that the district officer be requested to complete the papers by a full description of the lines after the Secretary of War has given his sanction to them.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 12, 1901.

Respectfully submitted to the Secretary of War.

The establishment of harbor lines in Bangor Harbor, Maine, being deemed essential to the preservation and protection of that harbor, the subject has been given careful consideration by Maj. S. W. Roessler, Corps of Engineers, who conferred with the municipal authorities and other interests involved. Attention is respectfully invited to his report of the 5th instant, herewith, and to the views of the division engineer in fourth indorsement hereon.

The lines selected for adoption are shown on the accompanying tracing.¹ These lines appear to be substantially satisfactory to the commercial interests of the harbor, and I recommend their approval.

The tracing has been prepared for the signature of the Secretary.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of February 18, 1901, the approval being indicated on the map.

LETTER OF MAJ. S. W. ROESSLER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., February 5, 1901.

GENERAL: In letter of June 15, 1900, Mr. George F. Evans, vice-president and general manager of the Maine Central Railroad, asked that certain changes be made in front of their railway property in the city of Bangor, Bangor Harbor, Maine, and in support of his request filed letters of approval from the board of trade of Bangor and from the municipal officers of the city of Brewer opposite. This letter was forwarded with my letter of June 16, 1900. By Department indorsement of June 25, 1900, all of the papers were returned with instructions to submit for the approval of the Secretary of War a system of harbor lines for this harbor in conformity with section 11 of the river and harbor act of March 3, 1899.

A public hearing was held at 3.30 p. m. at the city hall of Brewer on October 3, 1900, the long delay having been occasioned by the diffi-

¹ Not printed.

culty in agreeing upon a date convenient for all parties. Present at this hearing were:

W. H. Rollins, of E. H. & H. Rollins, owners of ice houses and shore property.
Peter Pooler, of Palmer & Pooler, coal merchants.
H. P. Sargent, of D. S. Sargent Sons, South Brewer, lumber manufacturers.
Frank Dingley, representing the American Ice Company.
H. S. Hoyt, alderman of Brewer.
Chas. C. Hoyt, alderman, and representing Eastern Manufacturing Company.
Ernest Prescott, of F. W. Ayers Company, lumber manufacturers.

A map of the harbor, which had been compiled in this office from the best available data, was laid before the meeting and those present were invited to suggest a harbor line upon the Brewer side of the river. No one seemed willing to make a definite recommendation, each one fearing that what he might suggest might not be wholly satisfactory to his neighbors. To bring on a discussion a trial line was drawn by myself in approximately the position I thought it should be so as to give the requisite wharf room along the shore and at the same time preserve a wide enough waterway to avoid the dangers of ice gorges and to carry off freshets without greatly accelerating the already high currents of about 6 miles an hour at this locality. The line as suggested cut off the ends of several wharves and brought out a lively discussion. In the course of the meeting it was suggested by two of the larger wharf owners on the Brewer side of the river that the map as drawn included only so much of the river as lay in front of the municipal district of Bangor and did not include all of the frontage along the municipality of the city of Brewer, and asked if possible that the harbor line be extended down at least as far as the pulp mill wharf. This desire being general, the meeting was adjourned to a future date and until a map of the lower portion of the harbor could be prepared.

The map having been extended, a second public meeting at the same place was held on November 21, 1900, at which were present

R. W. Stewart, of F. W. Ayers Company.
C. B. Clark, of the Eastern Manufacturing Company.
W. J. Sargent, alderman.
Frank Dingley, representing the American Ice Company.
Frank L. Marston, city engineer of Bangor.

The board of selectmen of the town of Hampden, abutting the municipality of Bangor on the western side of the river, were notified of the proposed extension of the harbor line along a portion of the frontage of their town and invited to be present at this meeting.

At this meeting a trial harbor line for the Brewer side of the river, identical in location, excepting at one point, with that indicated on the accompanying tracing,¹ was submitted to those present for discussion and remark. The line proposed seemed to meet with general approval from all parties present except Mr. Frank Dingley, representing the American Ice Company, who own the two wharves abreast of Smith's brickyard which were cut off by the proposed line, and the representative of Ayers's coal wharf, the end of which was cut off by the line as first proposed. Both parties, and especially Mr. Dingley, argued at length in favor of placing the line outside of their piers, but had no reason to urge in favor of their proposition except that their piers as now built should be regarded as invested interests that should not be

¹ Not printed.

interfered with without adequate cause. Each thought that his piers did not extend far enough into the river to prejudice navigation.

It was fully explained that the best harbor line for a narrow river like the Penobscot at Bangor, where both banks are occupied by wharves, is the one that will effect the most equitable compromise between seemingly opposite requirements. On the one hand are the ice houses, lumber factories, and other shore enterprises, which require as much room as possible outside of the bank line for the erection of their wharves, while on the other hand the needs of navigation and the importance of maintaining a wide channel, so as to prevent ice gorges and to pass off the freshets without unduly accelerating the currents, suggest that the harbor line on the two sides of the river should be kept as nearly parallel and as far apart as practicable and without too great or too sudden contraction at any one point; that in my opinion the position of the piers of the American Ice Company is such as to unduly contract the waterway in that vicinity, and that as the opposite bank line is practically a solid bulkhead for a length of nearly 1,000 feet, the only remedy is to cut off a small portion of the ends of these piers.

Subsequent to the meeting correspondence was had with both the representative of the American Ice Company and the owners of Ayers's coal wharf, and upon further consideration I have modified the line at the latter point so as to fall outside of the pierhead. The position of the line, however, at the American Ice Company's wharf has been maintained. A protest from the American Ice Company regarding the line in that vicinity is contained in their letter¹ of December 1, 1900, a copy of which is herewith inclosed. These people have been notified that if the harbor line as recommended to the Secretary of War is approved I should recommend that they be granted a special permit authorizing them to maintain their wharves in their present position until they require reconstruction or until their removal should be imperatively demanded in the interest of navigation, the object of such recommendation being to permit the owners to obtain the value of their wharves as now built before being required to rebuild them within the harbor line.

The only other point where the proposed harbor line falls in rear of a pierhead is near the upper end of the harbor at Lincoln & Woodman's wharf, and no objection to the proposed line at that point has been made.

As a matter of courtesy and with a view of avoiding any possible protest in the future, I have furnished a blue print of the proposed line to the mayor of Bangor, the mayor of Brewer, and to the board of selectmen of the town of Hampden. Letters approving the proposed location by the board of selectmen of Hampden and by the city councils of the cities of Bangor and Brewer are herewith.

The proposed harbor line is represented by a heavy black line on the accompanying tracing.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

¹ Not printed.

DESCRIPTION OF HARBOR LINE, BANGOR HARBOR, MAINE, APPROVED BY THE SECRETARY OF WAR FEBRUARY 18, 1901.

Beginning at the toll bridge at the upper end of the harbor, the harbor line on the Bangor side of the river coincides with the end of the shore pier for a distance of 91 feet, thence it continues a distance of 570 feet to the eastern corner of pier near Station VI; thence 119 feet to the southern corner of same pier; thence following the same straight course a further distance of 380 feet it falls 12 feet east of corner pier at Station V, and 18 feet west of pier near Station X, terminating at a point in prolongation of the end of the most southerly pier on the east side of Kenduskeag River at its mouth.

Beginning again at corner of pier near Station IV on the opposite side of Kenduskeag River, it continues 738 feet in a straight course, falling approximately 3 feet outside the pier line on which Stations III and III are located; thence it continues, following the broken line, intersecting the wharf line Station II; thence following the wharf line to southwest corner of Maine Central Railroad wharf; thence following the heavy broken line to northeast corner of "New" wharf and along face of said wharf to southeast corner of "Upper" wharf at L; thence to easterly corner of "Lower" wharf at M and along face of said wharf 191 feet to its southerly corner; thence following the broken line to eastern corner of Crosby's shipyard wharf; thence along the same broken line to eastern corner of Hodgson, Hall & Foster's lumber wharf and along end of wharf to southern corner; thence in a straight line to and along front face of a crib pier; thence in a straight line to and along front face of a second crib pier; thence in a straight line to eastern corner of pier of American Ice Company and along channel face of pier to southern corner; thence in a straight line to easterly corner of "loading pier," where it terminates.

On the Brewer side of the river, beginning at the upper end of the harbor, the harbor line begins at the toll bridge at a point 50 feet northwest of the front face of the shore pier of the bridge; from this point it continues in a straight course for a distance of 990 feet, cutting off 40 feet of Lincoln & Woodman's wharf, the course terminating 8 feet north of north corner of wharf of Smith, Morse & Co.; from latter point it continues parallel with front of this wharf to a point 8 feet north of the most westerly corner of same wharf; thence along the broken line falling on the channel side of intermediate wharves and through the westerly corners of the first group of cribs at Nealley & Sons' steam sawmill; thence to westerly corner of most advanced of second group of cribs; thence along the broken line, it cuts off 30 feet and 55 feet, respectively, of two piers now owned by the American Ice Company and located just below piers of marine railway; continuing, it follows the line of five crib piers as shown and passes through the front face of Ayers & Co.'s wharf; thence along broken line, it passes 5 feet in front of ice-house loading pier, 28 feet in front of Palmer's Sons mill and lumber wharf, 30 feet in front of pulp-mill wharf, and to northerly corner of "Old Pier;" from latter point it continues along channel face of pier; thence to northerly corner of South Brewer pier, where the line terminates.

S. W. ROESSLER,
Major, Corps of Engineers.

PORTLAND, ME., March 6, 1901.

A 16.

ESTABLISHMENT OF HARBOR LINES IN PORTLAND HARBOR, MAINE, INCLUDING FORE RIVER AND BACK COVE.

UNITED STATES ENGINEER OFFICE,
Portland, Me., November 30, 1900.

GENERAL: I have the honor to submit the following report of a public hearing held in this office November 15 and 16, 1900, for the purpose of determining the best line to recommend for approval by the Secretary of War as the harbor line for the harbor of Portland, Me. The hearing was held under authority conveyed by indorsement of October 8, 1900, and after due notice, conveyed to the general

public by the following item which was published in four of the principal local newspapers:

UNITED STATES ENGINEER OFFICE,
Portland, Me., October 16, 1900.

A public hearing will be held at the United States engineer office, room 24, Brown Block, 537 Congress street, Portland, Me., on Thursday, November 15, 1900, at 10 a. m., with a view to establishing harbor lines for the main harbor at Portland, Me., for Fore River on both sides, and for Back Cove.

S. W. ROESSLER,
Major, Corps of Engineers.

SUMMARY OF PROCEEDINGS.

The meeting was called at 10.10 a. m. November 15.

Present:

Mr. W. G. Davis, representing Commercial wharf.

Mr. W. R. Wood, representing Central wharf.

Mr. Fred. D. Conant, representing Union wharf.

Mr. Elias Thomas, representing Portland pier.

Mr. C. S. Cook, Mr. C. Hutchinson, of Symonds, Snow & Cook, representing Boston and Maine Railroad wharf and Brown's wharf.

Gen. John M. Brown, member Brown estate, owner of Brown's wharf.

Mr. E. B. Winslow, President Portland Stoneware Company.

Mr. George P. Wescott, representing Boston and Maine Railroad interests on Back Cove.

Hon. H. B. Cleaves, representing Boston and Maine interests on Back Cove.

Hon. Frank Robinson, mayor of Portland.

Mr. Charles A. Stout, city solicitor.

Mr. George Fernald, city engineer.

Mr. C. F. Farley, chairman board of harbor commissioners.

During the meeting several others came in, including Mr. C. F. Libby, representing Hobson's wharf, Mr. G. F. Murch, owner of some flats in Back Cove.

It was announced that the meeting was called pursuant to instructions from the Chief of Engineers and under the provisions of section 11 of the river and harbor act of March 3, 1899.

A joint letter from the proprietors of Union wharf, Central wharf, Long wharf, and Portland pier, dated June 30, 1900, was read, requesting that the dredging now in progress be carried nearer to their wharves than is contemplated in the approved project, or, if that can not be done, that the harbor line be advanced so as to permit owners to build their piers out to deep water. Following this was read a letter of October 3, 1900, from Major Roessler to the Chief of Engineers, requesting authority to hold a public hearing.

Mr. Farley, harbor commissioner, was asked by Major Roessler to state what line his board would recommend for the main harbor front below Portland Bridge. He stated that the board advised a close adherence to the harbor commissioners' line established by act of the Maine legislature in 1856, and gave the following as two principal reasons for the board's recommendation: The first reason was that in the opinion of the board the width of the harbor is none too great to provide easy movement of vessels to and from the wharves and at the same time to afford the needed anchorage room for merchant vessels and for the large fleet of yachts which frequent the harbor during a period of about four months of each summer season. The second reason was that the wharves at two points of the harbor front project from the shore on lines converging toward each other so that they could not be extended much, if any, beyond the present harbor com-

missioners' line without encroaching upon each other's privileges or narrowing the slips to an impracticable width. He explained that the line as recommended by the board cuts off about 220 feet of Brown's wharf, 200 feet of the Boston and Maine Railroad wharf, and 60 feet of Hobson's wharf, but otherwise conformed generally with the present line of pierheads.

Mr. Cook, of Messrs. Symonds, Snow & Cook, attorneys, suggested that the harbor line in the vicinity of Brown's wharf and the Boston and Maine Railroad wharf be modified so as to include these wharves also within its limits, but claimed the right to maintain the wharves in their present position and condition should the line as recommended by the harbor commissioners be adopted by the Secretary of War as the permanent harbor line for the harbor.

Mr. W. R. Wood, representing Central wharf, was willing to accept either the present harbor commissioners' line, as recommended by the harbor commissioners, or a more advanced one coinciding with the present limit of dredging, as might be deemed best in the interest of navigation, but thought that the dredging should be carried closer in to the pier heads than was now contemplated, but at a reduced depth, so as to avoid the possibility of undermining the ends of the wharves.

Mr. Farley stated that Mr. Franklin C. Payson, owner of the wharf next below Merchants wharf, was opposed to any change in the present harbor commissioners' line.

The large interests of the Grand Trunk wharves were not represented, but it was suggested that this was possibly an oversight on the part of their local agent, and it was asked, in the company's behalf, that an opportunity be granted the company to present its views regarding the harbor line in the vicinity of its wharves at an adjourned hearing. This was granted.

A general discussion followed, after which it was stated by Major Roessler that the concensus of opinion seemed to be in favor of the present harbor commissioners' line, and that the line as proposed seemed to him in the main judicious, but thought that a few minor modifications could advantageously be made so as to bring all existing wharves, excepting Brown's wharf, the Boston and Maine Railroad wharf, and Hobson's wharf, in rear of the harbor line to be established. This suggestion met with general approval.

Being asked for a recommendation of a line for Fore River, Mr. Farley stated that his board recommended the same line that was established by the legislature of the State of Maine in 1874. The recommendation met with general approval and was not discussed.

The harbor line for Back Cove was then taken up. No harbor line either by the State or General Government had been established for this portion of the harbor. Mr. Wescott, speaking in behalf of the Boston and Maine Railroad, which has recently leased the Marginal Way and obtained title to a large portion of the adjoining flats, recommended that the line between the Marginal Way and the lower half of the dredged channel be established at a uniform distance of 100 feet from the edge of the dredged channel, so as to leave sufficient room for the erection of a bulkhead and wharf between the Marginal Way and the harbor line for the accommodation of shipping. For a harbor line along the upper half of the dredged channel he recommended a line 100 feet from the edge of the channel and 300 feet from the edge of the Marginal Way. In answer to a question Mr. Wescott stated that

the railroad company had no plans in prospect for building wharves out to the line suggested by him, either along the lower half or the upper half of the dredged channel, and that he only had in view the possibilities of the future. Major Roessler stated that if no docks were to be erected now or in the near future he thought the harbor line might be carried a uniform distance of 100 feet from the Marginal Way, so as to maintain as far as practicable the present tidal prism of the cove and to leave the question of a farther advance of the line toward the dredged channel to be determined when actual or prospective necessity existed therefor.

The interests at the head of the cove are an electric-power station of the Portland Street Railroad Company, a coal yard, and the Portland Stoneware Company. The wharves of the two former are located upon a small channel which has been excavated at their owner's expense to connect them with the head of the channel excavated by the Government. This channel, besides furnishing access to these wharves, also provides an outlet for an important city sewer, and it was asked by Mayor Robinson, for the city, and Mr. Libby, for the railroad company, that the harbor line in that vicinity be established so as not to interfere with access to the head of this channel or to obstruct the sewer.

Mr. E. B. Winslow, president of the Portland Stoneware Company, and the largest shipper in the cove, desired for the northerly half of his wharf 100 feet more room than he now has for the additional wharf facilities which his growing business will require in the not distant future.

Mr. Farley stated that he was not prepared at this meeting to suggest a line for the main harbor on the Cape Elizabeth side below Portland Bridge, and requested an opportunity of doing so at an adjourned meeting after he could have an opportunity of consulting with persons who are very much interested in the subject, but who were not present at the meeting. This was granted and an adjourned meeting fixed for 10 o'clock a. m. November 16.

At the meeting on November 16 were present:

Hon. H. B. Cleaves, attorney.

N. R. Dyer.

Mr. Edwin C. Norton.

Mr. William Spear.

Hon. John W. Deering, ex-mayor of Portland.

Mr. E. C. Jordan, civil engineer.

Mr. C. F. Farley, chairman board of harbor commissioners.

Mr. Dyer stated that the present harbor commissioners' line passed very close to the end of the marine railway, and that his company desired the line to be advanced about 100 feet toward the channel, so as to permit an extension of the railway by this amount so as to accommodate vessels of greater draft than can now be taken in. It was also asked that the line be so established as to permit an extension of 100 feet in the ferry slip. It was further represented that a floating dock was in contemplation, and when constructed would be moored just west of the marine railway, and that 100 feet outside of the present harbor commissioners' line would be required for its accommodation. The request of the wharf owners met with the entire approval of Mr. Farley, of the harbor commissioners.

For a line between the end of the Ferry slip and the end of the breakwater the majority favored a straight course between a point 100

feet outside the end of the pier and Bug Light, so as to encroach as little as possible upon available anchorage room. A minority, including Mr. Farley, thought this line could be drawn so as to be either parallel to and 100 feet from the present harbor commissioners' line, or so that its prolongation would pass through the black buoy off Bug Light. Major Roessler thought that the more retired line should be adopted since there appeared to be no demand for dock facilities in that vicinity.

As to the harbor line west of the marine railway, it was the unanimous opinion that the line should be retired and established as indicated on the chart,¹ so as to preserve from encroachment by wharves or other permanent structures an area that is now largely used and needed as an anchorage ground for small yachts and fishing boats.

Mr. Jordan spoke in general terms of the needs of the Grand Trunk Railway for additional room in which to extend their wharves so as to accommodate the gradually increasing length of steamships now arriving at this port. He did not, however, appear as a representative of the company but as a member of the Board of Trade and as one more or less intimately acquainted with the need for larger wharf facilities in that portion of the harbor. Mr. Farley entirely concurred in the statements of Mr. Jordan, and was of the opinion that an advance of the line in that vicinity 100 feet outside of the present harbor commissioners' line would be advisable.

Mr. Farley expressed the hope that the line of pier-heads, as given in a scheme for steamship wharves at the foot of Munjoy Hill, prepared in 1869 by a board of commissioners appointed by the mayor of Portland, and of which two engineer officers and two Coast Survey officers were members, would be incorporated in the general scheme of harbor lines for the harbor of Portland. He did not believe that this scheme would be carried out in the near future, but, if ever, he expressed his opinion that it would be advisable to maintain the harbor line in the position indicated by the advisory board.

The hearing was then closed. Subsequent thereto an interview was had with Mr. Hight, attorney for the Grand Trunk Railway, who stated that the question of asking for more wharf room in front of the Grand Trunk wharves had been referred to the general manager of the road, and that this officer had stated that his company did not care to ask for an extension of the harbor line in front of their wharves at this time.

Description of proposed harbor line and remarks.—The harbor line proposed by the writer as a result of this hearing is shown on the chart¹ herewith. Along the main harbor front it coincides closely with the harbor commissioners' line established by the legislature of the State of Maine in 1856. Where deviations are indicated they have been made for the purpose of rectifying the line where unnecessary changes of direction and angles occur, and for the further purpose of embracing within it several wharves which project a few feet beyond the present harbor commissioners' line. The only marked deviation from the harbor commissioners' line is that shown on the Cape Elizabeth side of the main harbor, where, for the reason stated in the record of proceedings, it was deemed advisable to preserve from encroachment an area now largely used as an anchorage ground by small yachts and fishing boats.

¹Not printed.

In detail the line proposed is as follows:

Beginning at the southeast corner of Galt wharf at letter A, it continues in a straight course to the southeast corner of Franklin wharf at B, thence to the southwest corner of Franklin wharf at C, thence to the southeast corner of custom-house wharf at D, thence outside of intermediate wharves to the southeast corner of Central Wharf at E, thence through the corner of Union wharf at F to the end of High street wharf at G; thence it continues, following the present ends of piers and bulkheads to the southwest corner of Railroad wharf at H, thence to the southwest corner of the gas company's wharf at I. From I to J and from K to L, on Fore River, the line coincides exactly with the harbor commissioners' line as established by act of the legislature of the State of Maine in 1874. From L the line continues along the harbor commissioners' line to point M, thence continues in a broken line through N to O. From O to P the line lies 100 feet outside of the present harbor commissioners' line, so as to permit an extension of the marine railway and ferry slip and also to provide room for a floating wharf in contemplation. From P the line continues in a straight course, terminating at the end of the breakwater at Q.

Beginning again at the southeast corner of Galt wharf at A the proposed harbor line continues through the ends of Atlantic and Grand Trunk wharves to R. From R to S the line coincides with the line of pier heads laid down in the plan of docks prepared by the advisory board of 1869. From S, along the entrance to Back Cove, the line follows closely the line recommended by the same advisory board, terminating at Turkey's Bridge at the end of the solid fill in the abutment at T. From T the line continues to a point 100 feet from the dredged channel at U; thence at a distance of 100 feet from the Marginal way and 100 feet from the edge of the dredged channel to the point V, where it crosses an old abandoned wharf. From V to W it continues at a distance of 100 feet from the bulkhead of the Marginal way. From W to X it coincides with the direction of the end of the dredged channel. From X it continues through Y to point Z, at a distance of 100 feet outside of the present wharf of the Portland Stoneware Company. In Back Cove, above point Z, there are no wharves at the present time, nor any likely to be constructed in the near future; and on Fore River, above the upper bridge of the Boston and Maine Railroad, there are but few wharves, and these accessible only by boats of very small draft. For these reasons it is not deemed feasible to suggest harbor lines for these localities at the present time.

The line as indicated above has the approval of the harbor commissioners and of all others interested in the subject as far as known to the writer, excepting the owners of the Boston and Maine Railroad wharf, Brown's wharf, and Hobson's wharf along the main harbor front. To ascertain their views in writing, blue prints showing the proposed line have been furnished Mr. C. F. Libby, attorney for the owners of Hobson's wharf, and Messrs. Symonds, Snow, and Cook, attorneys for the other two wharves, with an invitation to file any statement they might desire to make for the information of the Secretary of War. Availing themselves of the opportunity thus offered, they have stated their position, in inclosures¹ herewith marked "1," "2," and "3," respectively, to which attention is respectfully invited.

The difficulty of rectifying the harbor line in the vicinity of the three wharves in question is one of long standing and beyond the disposition or ability of the city authorities to correct. All three were in existence substantially in their present form and dimensions when harbor lines were established by the State in 1856. Union wharf, which is the next large wharf to the east of Brown's wharf, also extended beyond the harbor commissioner's line at the time of its adoption by the State, but was cut off in conformity with the requirements of this act, the expense of the work being borne partly by the owners and partly by the city. A similar effort was made to accomplish the removal of so much of Brown's wharf as extended beyond the established line, but failed of result because of the powerful opposition of the owners, who

¹ Not printed.

are among the wealthiest people of the city and State. So far as the writer has learned, no attempt has been made in recent years to secure a compliance with the State act in question. On the contrary, it would appear that the city has accepted the situation as a permanent one from the fact that some years since, when the end of Brown's wharf was badly damaged by fire, a permit was issued for its reconstruction, with the proviso that should the city at any time decide upon its removal the cost of repairs, if any, should be deducted from the estimated value of the wharf at the time of its removal. So far as the city is concerned I do not think the attempt to rectify the harbor line in this locality will be revived.

In view of these facts it would seem advisable to modify the harbor line in this vicinity so as to embrace these wharves within its limits; but for the reasons stated in the record of the public hearing, and in deference to the general sentiment of those interested in the navigation of the harbor, it is deemed best to meet the situation by maintaining the present harbor commissioners' line in that vicinity and by authorizing the maintenance of these wharves in their present position by a special permit, revocable at the pleasure of the Secretary of War when their removal is imperatively demanded in the interest of navigation.

Should the line as recommended be approved, the owners of the wharves projecting beyond it will be notified to submit their application with a view to receiving a special permit for their maintenance.

The establishment of permanent marks to indicate changes of direction in the proposed line, where these fall within the limits of existing wharves, and their reference to permanent bench marks, has been deferred until after the approval of the line by the Secretary of War.

The proposed line from Galt wharf to Portland Bridge, in the main harbor, lies at a distance varying from nothing to about 200 feet behind the limit of dredging authorized under the present contract. If the harbor line recommended is approved by the Secretary of War, it would follow as a natural sequence that the deepening of the harbor should be carried nearer to the ends of the wharves than is contemplated under the authorized plan of improvement. Authority is requested to make such revision of the existing dredging project as will accomplish this object, should the proposed line be favorably considered.

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY.
February 19, 1901.

Respectfully referred to Col. G. L. Gillespie, Corps of Engineers, division engineer, northeast division, for consideration and recommendation.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, February 20, 1901.

Respectfully returned to the Chief of Engineers, concurring in the views and recommendations of the district officer.

Hobson, Boston and Maine, and Brown's wharves (main harbor) all project too far into the harbor; but since they were built prior to the appointment of State harbor commissioners, one at least being composed largely of stone facings and earth fillings and have always been maintained as shipping wharves, it is not deemed advisable to demand now a reduction of length to conform to the harbor lines in their rear, as established by the State harbor commissioners.

I therefore concur in the recommendation of the district officer that the parts of these wharves which project beyond the harbor line be authorized to be maintained by their owners under a revocable license to be issued by the Secretary of War; and I further recommend that the project for deepening the harbor be enlarged to provide for carrying the dredged channel as close to the outer ends of adjacent wharves as will be consistent with their safety.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
 U. S. ARMY,
April 4, 1901.

Respectfully submitted to the Secretary of War.

The subject of the establishment of harbor lines for the harbor of Portland, Me., has been given careful consideration by the local engineer officer, who submits the within report and accompanying tracing, on which is indicated in red harbor lines for the main harbor, Fore River, and portion of Back Cove, which in his judgment should be adopted.

These lines appear to meet with general approval on the part of local interests, who were accorded a public hearing and afforded every opportunity to present their views.

I recommend that the lines be approved and that the Secretary of War place his approval on the tracing which has been prepared for his signature.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of April 5, 1901, the approval being indicated on the map.

APPENDIX B.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE SOUTH OF PORTLAND HARBOR; IN VERMONT AND NEW HAMPSHIRE, AND IN MASSACHUSETTS NORTH OF LYNN HARBOR; NARROWS OF LAKE CHAMPLAIN, NEW YORK AND VERMONT.

REPORT OF CAPT. HARRY TAYLOR, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|--|
| 1. Saco River, Maine. | 11. Gloucester Harbor, Massachusetts. |
| 2. Cape Porpoise Harbor, Maine. | 12. Manchester Harbor, Massachusetts. |
| 3. Cocheco River, New Hampshire. | 13. Sea Wall at Marblehead, Massachusetts. |
| 4. Exeter River, New Hampshire. | 14. Burlington Harbor, Vermont. |
| 5. Little Harbor, New Hampshire. | 15. Otter Creek, Vermont. |
| 6. Newburyport Harbor, Massachusetts. | 16. Narrows of Lake Champlain, New York and Vermont. |
| 7. Merrimac River, Massachusetts. | |
| 8. Powow River, Massachusetts. | |
| 9. Essex River, Massachusetts. | |
| 10. Harbor of Refuge at Sandy Bay, Cape Ann, Massachusetts. | |

EXAMINATIONS AND SURVEYS.

- | | |
|---|--|
| 17. Hendersons Point (Me.), Portsmouth Harbor, New Hampshire. | 18. Beverly Harbor, Massachusetts. |
| | 19. Breakwater at Burlington, Vermont. |

UNITED STATES ENGINEER OFFICE,
Portsmouth, N. H., July 13, 1901.

GENERAL: I have the honor to transmit herewith annual report upon the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1901.

* * * * *

Very respectfully, your obedient servant,

HARRY TAYLOR,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

B I.

IMPROVEMENT OF SACO RIVER, MAINE.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 133.

The operations during the past fiscal year consisted in repairing the south jetty by raising several low places where it had settled, and in constructing a beacon at its outer end. The work was done in June and July, 1900, under contract with George Willett Andrews, a total of 1,985 tons of stone being placed in the jetty.

An examination of the river made in 1896 showed that the 6-foot channel had developed under the combined influence of the breakwater and jetty, but an examination made in June, 1900, showed that there is but $3\frac{1}{2}$ feet of water at mean low tide on the bar just outside the breakwater and jetty.

In order to maintain the desired depth the breakwater on the north side should be extended to Sharps Ledge, as contemplated in the plan presented to Congress in 1883, in order to stop the influx of sand from that side, the 6-foot channel having evidently been filled by the extension of the north spit southward past the end of the breakwater. It is possible the jetty on the south side may require some extension, but present circumstances do not indicate it.

An estimate for completing the improvement of this river appears on page 1144 of the Annual Report of the Chief of Engineers for 1900.

Saco is situated in the collection district of Saco, Me., of which Saco is the port of entry. The nearest light-house is Wood Island light.

Money statement.

July 1, 1900, balance unexpended	\$8,177.58
June 30, 1901, amount expended during fiscal year	2,935.95
July 1, 1901, balance unexpended	5,241.63
{ Amount (estimated) required for completion of existing project	70,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	70,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—

March 2, 1827, for piers, buoys, and removing obstructions at and near entrance	\$7,000
June 23, 1866, for repairing piers	40,000
March 2, 1867, for improving river	40,000
July 25, 1868, for improving river	20,000
April 10, 1869, for improving river	22,275
July 11, 1870, for improving river	10,000
March 3, 1871, for improving river	15,000
June 10, 1872, for improving river	15,000
July 5, 1884, for breakwater	15,000
August 5, 1886, for breakwater	12,500
August 5, 1886, for improving river	12,500
August 11, 1888, for breakwater	12,500

Act of—

August 11, 1888, for improving river	\$10, 000
September 19, 1890, for improving river, including breakwater and jetty ..	65, 000
July 13, 1892, for improving river, including breakwater	25, 000
August 18, 1894, for improving river, including breakwater	10, 000
June 3, 1896, for improving river, including breakwater	10, 000
March 3, 1899	5, 000
Total	346, 775

Contract in force during fiscal year ending June 30, 1901.

Contractor.	Entered into.	Price per ton of 2,000 pounds of stone placed in the work.	Approved.	Commence.	Complete.
George Willett Andrews, Biddeford, Me.	Apr. 18, 1900	\$1.37	Apr. 28, 1900	Within 30 days after notice of approval of contract.	Within 60 days after date of commencement.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1891	49, 765
1892	47, 108
1893	59, 765
1894	47, 350
1895	62, 129
1896	46, 956
1897	42, 214
1898	44, 508
1899	46, 597
1900:	
Bricks	2, 500
Coal	46, 210
Iron	1, 544
Gravel	100

50, 354

Arrivals and departures in calendar year 1900.

Sailing vessels with an average draft of 12 feet and average tonnage of 300 tons:	
Coastwise	117
Foreign	7

B 2.

IMPROVEMENT OF HARBOR AT CAPE PORPOISE, MAINE.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 135.

The expenditures during the fiscal year were \$66,654.00.

In October, 1899, contract was entered into with George F. Taylor

for doing the entire work, estimated at 717,000 cubic yards, at 9.2 cents per cubic yard. Work under the contract was commenced early in June, 1900, and completed December 28, 1900.

The harbor is now dredged to full projected dimensions except a small area in the northern part of the harbor, where a small quantity of ledge was found. The total number of cubic yards excavated was 683,183, or 33,817 yards less than the original estimate.

Owing to the low price at which the contract for the dredging was let, and the fact that the actual quantity of material dredged was less than originally estimated, the total cost of the improvement will be reduced about \$50,000 below the original estimate of \$125,000.

The work of removing the ledge mentioned above, containing about 370 cubic yards, has been let to John J. Fitzpatrick, of Plattsburg, N. Y., whose contract requires that the work be completed on or before September 30, 1901. With the removal of the ledge the improvement of this harbor will be completed as projected.

The harbor in its original condition was much used as a harbor of refuge by small vessels in bad weather and is now available for vessels up to 15 feet draft.

This work is located in the collection district of Kennebunk, Me., of which Kennebunk is the port of entry. The nearest light-house is on Goat Island, at the entrance to the harbor.

Money statement.

July 1, 1900, balance unexpended	\$79,494.54
June 30, 1901, amount expended during fiscal year	66,654.00
July 1, 1901, balance unexpended	12,840.54
July 1, 1901, amount covered by uncompleted contracts	4,218.00

APPROPRIATIONS.

Act of—

March 3, 1899	\$70,000
June 6, 1900	10,000
Total	80,000

Contracts in force during fiscal year ending June 30, 1901.

Contractor.	Price per cubic yard for dredging, scow measurement.	Total price for removing ledge. (Estimated quantity, 370.6 cubic yards.)	Entered into.	Approved.	Commence.	Complete.
Dredging: George F. Taylor, New York, N. Y.	\$0.092	.....	1899. Oct. 24	1899. Nov. 11	1900. May 15	1900. Nov. 15
Ledge removal: John J. Fitzpatrick, Plattsburg, N. Y.	.....	\$4,218	1901. Apr. 15	1901. Apr. 27	1901. July 1	1901. Sept. 30

COMMERCIAL STATISTICS.

The harbor up to the present time has been used principally as a harbor of refuge for fishermen, but an electric road 22 miles long has been built from Cape Porpoise to the manufacturing town of Sanford, Me., and an official of the road has stated that it is expected a line of steamers will be put on between Cape Porpoise and Boston, and perhaps Portland. He further stated that it is proposed to bring all the coal (about 20,000 tons per year) used in Sanford and all raw material for the mills into this port. It is reported that eight large fishing schooners make this harbor their home port.

B 3.

IMPROVEMENT OF COCHECO RIVER, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 135.

No operations have been in progress during the fiscal year, and at the date of this report the condition of the improvement is the same as on June 30, 1900.

This work is located in the collection district of Portsmouth, N. H., of which Portsmouth is the port of entry. The nearest light-house is Portsmouth light, at the entrance to Portsmouth Harbor.

Money statement.

July 1, 1900, balance unexpended	\$6, 075. 52
June 30, 1901, amount expended during fiscal year	. 31
July 1, 1901, balance unexpended	6, 075. 21
{ Amount (estimated) required for completion of existing project	85, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	45, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	\$5, 000	July 5, 1884	\$28, 000
March 3, 1837	5, 000	August 5, 1886	10, 000
March 3, 1871	10, 000	August 11, 1888	9, 000
June 10, 1872	10, 000	September 19, 1890	25, 000
March 3, 1873	10, 000	July 13, 1892	15, 000
June 23, 1874	10, 000	August 18, 1894	15, 000
March 3, 1875	25, 000	June 3, 1896	15, 000
August 14, 1876	14, 000	March 3, 1899	20, 000
June 18, 1878	6, 000		
August 2, 1882	28, 000	Total	260, 000

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1891	70, 662
1892	71, 785
1893	66, 933
1894	68, 415
1895	83, 151
1896	59, 755
1898	131, 005
1899	144, 040

1900:	Tons.
Coal.....	38,000
Bricks.....	30,000
Lumber.....	40,000
Cement, lime, and plaster.....	45,000
Phosphate.....	300
Sand (molding).....	250
Wood.....	1,500
Ashes.....	62
Potatoes.....	31
Apples.....	37
	155,180
<i>Arrivals and departures in calendar year 1900.</i>	
Vessels arriving.....	60
Tugs.....	160
Barges.....	200

B 4.

IMPROVEMENT OF EXETER RIVER, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 136.

The improvement of the channel, under the project submitted in 1897, which was in progress at the close of the last fiscal year under contract with Augustus B. Martin, was continued down river as far as available funds would permit. The contract was completed September 14, 1900, when a total of 17,116 cubic yards of material had been dredged and 115 tons of bowlders greater than 3 tons in weight removed. This work completed the channel to full projected dimensions from Gilman's wharf, Exeter, down to Swamscot Bar, opposite Newfields.

As the work progressed it was found that the actual amount of excavation to be done was much more than the original estimate, the depth of water being considerably less in places than shown by the survey made in 1896, upon which the estimate of the present project was based. More filling in was found in the upper part of the channel than below, partly due to deposits from sewage which empties into the river at Exeter.

The following estimate of the amount required to complete the present project was submitted in the last annual report:

8,000 cubic yards dredging, at 75 cents.....	\$6,000
Contingencies.....	1,000
Total.....	7,000

This work is located in the collection district of Portsmouth, N. H., of which Portsmouth is the port of entry. The nearest light-house is Portsmouth light, at the entrance to Portsmouth Harbor.

Money statement.

July 1, 1900, balance unexpended.....	\$10,751.21
June 30, 1901, amount expended during fiscal year.....	10,654.24
July 1, 1901, balance unexpended.....	96.97
{ Amount (estimated) required for completion of existing project.....	7,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	7,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—

June 14, 1880	\$20,000
March 3, 1881	15,000
March 3, 1899	12,000
Total	47,000

Contract in force during fiscal year ending June 30, 1901.

Contractor.	Entered into.	Price—		Approved.	Commence.	Complete.
		Per cubic yard, for dredging, scow measurement.	Per ton, for removing bowlders greater than 3 tons in weight.			
Augustus B. Martin, Boston, Mass.	Mar. 28, 1900	<i>Cnts.</i> 54	\$10	Apr. 18, 1900	Within 10 days after notice of approval of contract.	Within 7 months from date of commencement.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1896	10,166
1899	10,920
1900:	
Coal	10,200
Fish (in pickle)	105
Wood (cord)	322
Leather (scrap)	175
	10,802

Arrivals and departures.

Schooners, about 200 tons capacity each	28
Gondolas, about 80 tons capacity each	10
Gondolas, about 50 tons capacity each	76
Average draft of schooners, about 9½ feet; average draft of gondolas, for river freighting, 5 feet.	
One river barge of 125 tons capacity is in process of construction.	

B 5.**HARBOR OF REFUGE AT LITTLE HARBOR, NEW HAMPSHIRE.**

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 137.

The expenditures during the fiscal year 1901 were \$11,069.75. At the close of the fiscal year 1900, 25,735.6 cubic yards of material had been dredged during the year, which widened the anchorage area about 50 feet. During the fiscal year 1901 the work was continued and

38,064.4 cubic yards were removed, widening the anchorage area about 75 feet more. These operations were carried on with the appropriation of \$12,000 made by the act of March 3, 1899, under contract with Charles H. Souther. Work was commenced May 31, 1900, and completed August 15, 1900, when a total of 63,800 cubic yards had been dredged under this contract, widening the anchorage area a total of 125 feet on the southern side, where it is about 2,000 feet in length.

This work is located in the collection district of Portsmouth, N. H., of which Portsmouth is the port of entry. The nearest light-house is Whale Back light, Portsmouth Harbor, New Hampshire.

Money statement.

July 1, 1900, balance unexpended	\$11,365.57
June 30, 1901, amount expended during fiscal year	11,069.75
July 1, 1901, balance unexpended	295.82
{ Amount (estimated) required for completion of existing project	13,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	13,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
August 5, 1886.....	\$10,000	June 3, 1896.....	\$10,000
August 11, 1888.....	20,000	March 3, 1899.....	12,000
September 19, 1890.....	40,000		
July 13, 1892.....	30,000	Total	132,000
August 18, 1894.....	10,000		

Contract in force during fiscal year ending June 30, 1901.

Contractor.	Entered into.	Price per cubic yard, scow measurement.	Approved.	Commence.	Complete.
Chas. H. Souther, Boston, Mass.	Mar. 28, 1900	<i>Cents.</i> 16½	Apr. 5, 1900	Within 45 days after notice of approval of contract.	Within 5 months from date of commencement.

COMMERCIAL STATISTICS.

The prospective benefits to commerce and navigation by the construction of this harbor of refuge are, primarily, increased safety to life and property, there being neither imports nor exports. During the calendar year 1900 the harbor was frequented by 180 vessels, as follows:

Seventy-two schooners—average draft, 7 feet; average tonnage, 75.

Sixty-eight steamers, yachts, and tugs—average draft, 8 feet; average tonnage of steamers, about 300 tons.

Forty sloop-yachts—average draft, 4 feet; average tonnage, 25.

The following is an extract from statistics submitted by the superintendent of the first life-saving district:

“This list is of vessels which sought the harbor for anchorage—coasting vessels and pleasure craft—and the draft of water and tonnage are as near as could be averaged. Those who have sought the harbor speak very highly in its favor.”

B 6.

IMPROVEMENT OF NEWBURYPORT HARBOR, MASSACHUSETTS.

Newburyport, Mass., is situated about $2\frac{1}{2}$ miles from the Atlantic Ocean, on the south bank of Merrimac River. The river empties into the Atlantic Ocean midway between Cape Ann and Portsmouth, or about 30 miles a little east of north from Boston in a direct line.

The outlet of the river between Plum Island and Salisbury Point is 1,000 feet wide and 30 feet deep at mean low water. At a distance of nearly a mile outside lies a sandy bar, thrown up by wave action, through which, previous to the improvement, a channel, variable in position and depth, was maintained by the current of the river, increased by the tidal flow in a large interior basin through a mean range of tides of 7.7 feet. For 1,000 feet outward from the gorge toward the crest of the bar the current was able to maintain a channel of navigable width and 18 feet deep at mean low water, and for a farther distance of 1,500 feet a channel 12 feet deep. From the 18-foot contour line on the inside to the same on the outside the distance was 4,000 feet, and between the 12-foot contours the distance was 3,000 feet. The depth on the crest of the bar was generally less than 7 feet at mean low water.

The approved project and report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 138.

No work having been done during the fiscal year 1901, the condition of this improvement remained the same as on June 30, 1900.

A survey made during June, 1901, shows that there has been some improvement in the depth on the bar, the controlling depth in 1901 being 12.6 feet at mean low water, as against 11 feet at mean low water in 1899, when the last previous survey was made. The channel had moved slightly to the north of its 1899 position, but retained about the same width as it had at that time.

Nothing has yet been done toward the removal of North Rock, authorized by the act of March 3, 1899, but the work has been let and the rock will be removed within the next two months.

The advantage to be derived from the completion of the project is the deepening and widening of the channel across the bar, thereby affording a harbor of refuge on the inside of Salisbury Beach and giving easy access at high tide to the wharves at Newburyport for vessels drawing 17 feet, approximately.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the port of entry. The nearest light-house is on Plum Island, at the entrance of the harbor.

Money statement.

July 1, 1900, balance unexpended	\$9, 720. 92
June 30, 1901, amount expended during fiscal year	6, 261. 21
July 1, 1901, balance unexpended	3, 459. 71
July 1, 1901, outstanding liabilities	13. 47
July 1, 1901, balance available	3, 446. 24
{ Amount (estimated) required for completion of existing project	264, 047. 49
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	264, 047. 49
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
June 14, 1880	\$50,000	July 13, 1892	\$20,000
March 3, 1881	40,000	August 18, 1894	20,000
August 2, 1882	40,000	June 3, 1896	16,000
July 5, 1884	40,000	March 3, 1899	25,000
August 5, 1886	37,500		
August 11, 1888	25,000	Total	338,500
September 19, 1890	25,000		

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1899	180,600
1900:	
Coal	127,800
Lumber	540
Stone	100
Total	128,440

During the year 1900 there were 150 arrivals of vessels; total tonnage, 87,000; value, \$2,445,000. The vessels are barges and schooners, with a draft of water ranging from 10 to 14 feet. The barges average 1,000 tons and the schooners 600 tons.

Two schooners of about 900 tons were built in the vicinity during the year.

B 7.

IMPROVEMENT OF MERRIMAC RIVER, MASSACHUSETTS.

The approved project and report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 139.

The river and harbor act of March 3, 1899, appropriated \$40,000 for improvement of the river in accordance with the project submitted May 5, 1897. On July 5, 1899, a project was approved for the expenditure of this appropriation in dredging the channel to full proposed width and depth from Haverhill for as great a distance down the river as the funds would permit.

Contract for the work was entered into September 21, 1899, the work to commence in the spring of 1900, after the subsidence of the annual freshet in the river. Owing to the failure of the contractor to commence the dredging as required, the contract was annulled May 29, 1900, and the work readvertised.

Under the new advertisement the contract for the dredging was let September 15, 1900, to R. B. Rodermond, of New York City, at the same price as the former contract. Owing to the contractor's delay only one day's work was accomplished in the season of 1900. Dredging was resumed June 5, 1901, and at the close of the fiscal year a total of 4,792 cubic yards had been removed, completing about 1,100 feet of the channel just below Haverhill to 90 feet width and full depth.

NOTE: SOUNDINGS ARE EXPRESSED IN FEET AND TENTHS
 OF A FOOT REFERRED TO THE PLANE OF MEAN LOW WATER

THE MEAN HIGH WATER LINE IS SHOWN THUS 

BENCHMARK IS A BRICK HOUSE, CLAMPTON, THE THIRD COURSE OF MASONRY, TAKING THE 1851 BLACK ROCK BEACON AS REFERENCE 5.922 FEET ABOVE MEAN LOW WATER

MEAN HIGH WATER LINE SHOWN THUS 

MEAN HIGH WATER LINE TAKEN FROM OLD PLAN SHOWN THUS (1899) 

MEAN LOW WATER LINE SHOWN THUS 

6 FT. CONTOUR 

12 

18 

24 

MERRIMAC RIVER

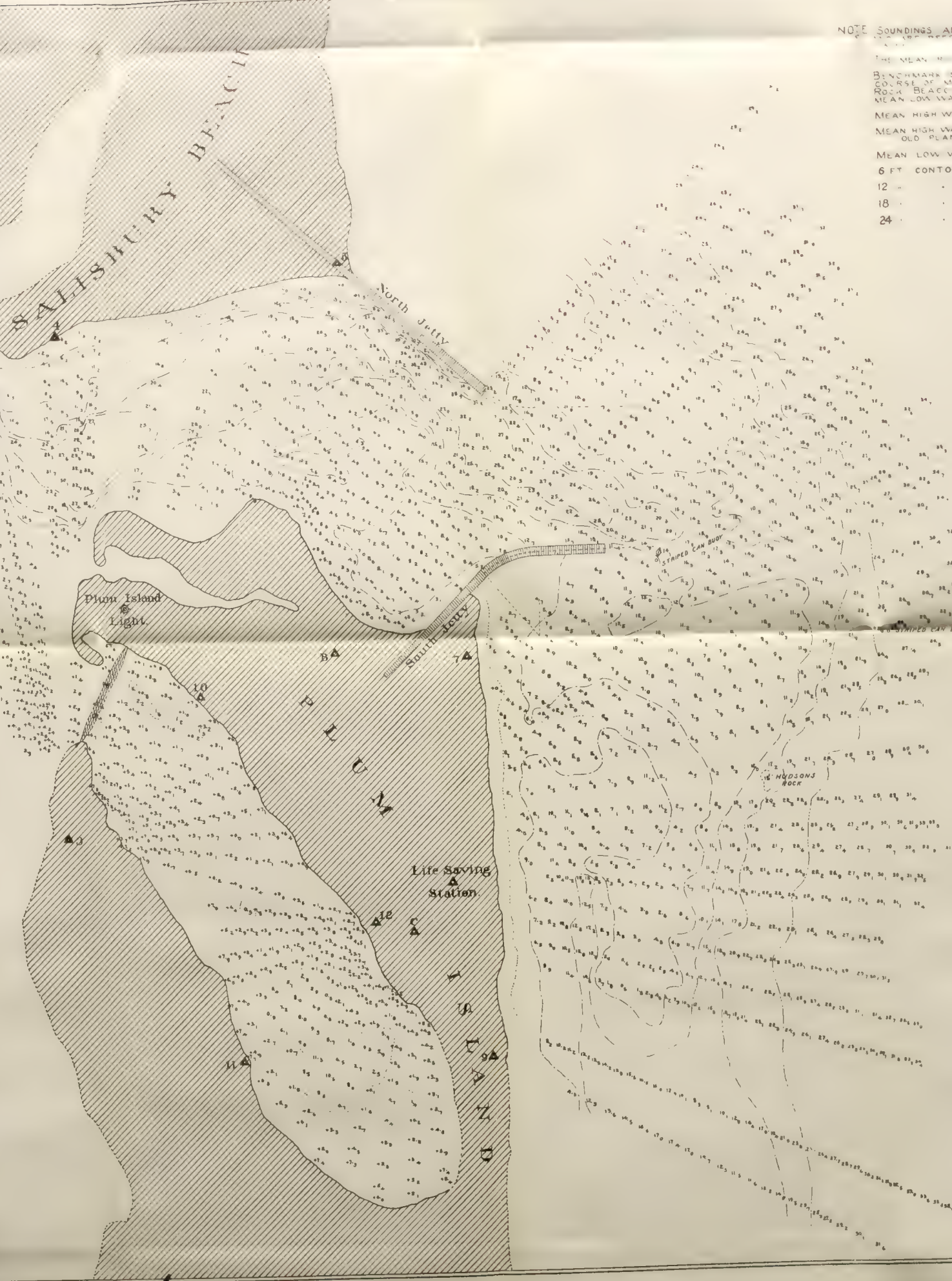
NEWBURYPORT HARBOR, MASSACHUSETTS.

SURVEY OF BAR AND ENTRANCE
 MADE UNDER THE DIRECTION OF
 CAPT. HARRY TAYLOR, CORPS OF ENGINEERS, U.S.A.
 JUNE, 1901.

SCALE 1 : 7500.



U.S. ENGINEER OFFICE,
 Portsmouth, N.H., July 13, 1901.
 To accompany Annual Report for fiscal
 year ending June 30, 1901.
Harry Taylor
 Capt. Corps of Engineers



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Money statement.

July 1, 1900, balance unexpended	\$40,081.61
June 30, 1901, amount expended during fiscal year	1,511.03
July 1, 1901, balance unexpended	38,570.58
July 1, 1901, outstanding liabilities	2,412.67
July 1, 1901, balance available	36,157.91
July 1, 1901, amount covered by uncompleted contracts	33,627.96
{ Amount (estimated) required for completion of existing project	131,442.70
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
May 23, 1828	\$32,100.00	March 3, 1879	\$5,000.00
April 2, 1830	3,506.72	June 14, 1880	12,000.00
March 2, 1831	16,000.00	March 3, 1881	9,000.00
March 2, 1833	4,900.00	August 2, 1882	9,000.00
June 28, 1834	3,860.00	July 5, 1884	3,500.00
July 11, 1870	25,000.00	September 19, 1890	10,000.00
March 3, 1871	25,000.00	July 13, 1892	1,500.00
June 10, 1872	25,000.00	June 3, 1896	5,000.00
March 3, 1873	25,000.00	March 3, 1899	40,000.00
June 23, 1874	10,000.00		
March 3, 1875	12,000.00	Total	287,366.72
June 18, 1878	10,000.00		

Contract in force during fiscal year ending June 30, 1901.

Contractor.	Price per cubic yard.		Entered into.	Ap- proved.	Commence.	Com- plete.
	For dredg- ing scow measure- ment.	For remov- ing bowl- ders ex- ceeding 3 tons in weight.				
R. B. Rodermond, New York, N. Y.	\$0.495	\$10	1900. Sept. 15	1900. Oct. 9	21 days after date of notification of approval of contract.	1901. Nov. 15

COMMERCIAL STATISTICS.

The commerce involved in this improvement consists of supplies of coal, lumber, etc., for the cities and towns along its banks, the amount of coal reported in 1899 being 52,000 tons, and in 1900, 60,000 tons.

Arrivals and departures.

Schooners, tonnage 400, draft 12 feet	9
Barges, tonnage 1,000, draft 14 feet	4

The greater part of the coal is taken up in flat-bottomed scows.

B 8.

IMPROVEMENT OF POWOW RIVER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 140.

The river and harbor act of March 3, 1899, appropriated \$12,000 for the improvement of this river, and dredging was begun in August, 1899, and continued slowly until the following spring, when the contract was annulled through the failure of the contractor to prosecute the work as required. The work was then completed by R. B. Rodermond under open market agreement upon the same terms as the contract which was annulled, viz, 49½ cents per cubic yard. Work under the open market agreement was commenced in June, 1900, and completed in November, 1900.

During the past fiscal year 10,479 cubic yards of material were removed, widening the channel to 45 feet for a distance of 2,900 feet down river.

The river was increased to 45 feet in width to full depth for a distance of 3,130 feet under the contract and 3,090 feet under the agreement, which makes the channel at present 45 feet wide and 12 feet deep at mean high water from the head of navigation at Amesbury to just above the highway bridge at Salisbury Point, where a section of 650 feet yet remains to be done. This section is at least 30 feet wide.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the port of entry. The nearest light-houses are the Plum Island lights and the Newburyport Upper Harbor lights.

Money statement.

July 1, 1900, balance unexpended	\$4,455.76
June 30, 1901, amount expended during fiscal year	4,396.48
July 1, 1901, balance unexpended	59.28
{ Amount (estimated) required for completion of existing project	49,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	49,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
August 11, 1888	\$3,000	June 3, 1896	\$12,000
September 19, 1890	5,000	March 3, 1899	12,000
July 13, 1892	4,000		
August 18, 1894	15,000	Total	51,000

COMMERCIAL STATISTICS.

The commerce involved in this improvement consists principally of supplies of coal for local consumption, a total of about 5,000 tons being reported in 1900.

B 9.

IMPROVEMENT OF ESSEX RIVER, MASSACHUSETTS.

The approved project and report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 141.

On June 30, 1900, the channel had been dredged to its full projected depth, 60 feet wide for a distance of 4,000 feet below the highway bridge in Essex, and at least 25 feet wide for the remainder of the distance to its lower end.

The river and harbor act of March 3, 1899, appropriated \$10,000 to complete the improvement of this river, and during the past fiscal year the project was completed, the improved channel now being 60 feet wide and at least 4 feet deep from the mouth of the river up to the highway bridge at Essex. The dredging was commenced in September, 1900, under contract with Augustus B. Martin, and completed in November of the same year, when a total of 14,094 cubic yards had been removed under the contract.

Essex River is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is Annisquam light, 2 miles east of the mouth of the river.

Money statement.

July 1, 1900, balance unexpended	\$10, 236. 22
June 30, 1901, amount expended during fiscal year	6, 535. 43
July 1, 1901, balance unexpended	3, 700. 79

APPROPRIATIONS.

Act of—

July 13, 1892	\$5, 000
August 18, 1894	5, 000
June 3, 1896	5, 000
March 3, 1899	10, 000
Total	25, 000

Contract in force during fiscal year ending June 30, 1901.

Contractor.	Entered into.	Price—		Approved.	Commence.	Complete.
		Per cubic yard for dredging, scow measurement.	Per ton, for removing bowlders over 3 tons in weight.			
Augustus B. Martin, Boston, Mass.	1900. Apr. 27	Cents. 40	\$4.00	1900. May 9	Within 100 days after notice of approval of contract.	Within 4 months from date of commencement.

COMMERCIAL STATISTICS.

The principal industry of Essex, and the only one interested in the improvement of the river, is vessel building. During the year 24 vessels were built, with a total tonnage of 5,000. Twenty-two of these vessels were sailing craft and 2 steam, one of the latter having a tonnage of 500.

B 10.

IMPROVEMENT OF HARBOR OF REFUGE, SANDY BAY, CAPE ANN,
MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 141.

During the past fiscal year operations have been in progress under the appropriation of \$250,000 made by the river and harbor act of March 3, 1899. A project for the expenditure of \$110,000 of this appropriation in continuing construction of the substructure was approved July 14, 1899. Work under this project was commenced in September, 1899, and has been continued during the past fiscal year on both arms of the breakwater. A total of 107,868 tons of rubble-stone was placed in the breakwater during the year, completing the substructure of the southern arm to mean low water, except for a distance of 70 feet over which nothing has been done. A section of about 100 feet of the substructure of the western arm was also raised to mean low water where it was formerly 22 feet below mean low water, 40 feet wide on top.

Under date of March 21, 1901, a project was approved for the expenditure of the balance of the appropriation of the act of March 3, 1899, in completing the substructure of the southern arm and continuing the substructure of the western arm. Contract for the work has been let, and it is expected that all available funds will be expended in this way before September 30, 1902.

Sandy Bay is situated in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is Straitsmouth light, at the southern entrance of the bay.

Money statement.

July 1, 1900, balance unexpended	\$221,065. 16
June 30, 1901, amount expended during fiscal year	62, 859. 82
July 1, 1901, balance unexpended	158, 205. 34
July 1, 1901, outstanding liabilities	21, 324. 89
July 1, 1901, balance available	136, 880. 45
July 1, 1901, amount covered by uncompleted contracts.....	121, 400. 00
{ Amount (estimated) required for completion of existing project	3, 850, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	500, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
July 5, 1884.....	\$100, 000	August 18, 1894	\$150, 000
August 5, 1886	100, 000	June 3, 1896	150, 000
August 11, 1888	100, 000	March 3, 1899.....	250, 000
September 19, 1890	150, 000		
July 13, 1892.....	150, 000	Total	1, 150, 000

Contracts in force during fiscal year ending June 30, 1901.

Contractors.	Price per ton of 2,000 pounds.	Entered into.	Approved.	Commence.	Complete.
Rockport, Pigeon Hill, and Cape Ann Granite Cos., Rockport, Mass.	\$0.63	1899. Sept. 20	1899. Oct. 6	Within 15 days after notice of approval.	1901. June 30
Do.....	.607	1901. May 31	1901. June 14	July 1, 1901	1902. Sept. 30

COMMERCIAL STATISTICS.

The entire commerce of New England is directly interested in this improvement. Large shipments of stone are made from several little ports in the vicinity of Sandy Bay, and fish and supplies of coal, etc., are received at these ports, the total amounting annually to between 300,000 and 500,000 tons. While this shipping would be benefited by the harbor, these local statistics have no value as measuring the importance of the improvement.

B II.

IMPROVEMENT OF HARBOR AT GLOUCESTER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 143.

During the past fiscal year operations have been continued under contract with Rockport, Pigeon Hill, and Cape Ann Granite companies, and consisted in the construction of superstructure, beginning at Eastern Point. The contract was completed October 15, 1900, when the superstructure was completed for a distance of 284 linear feet from the shore end at Eastern Point. The following quantities of material were used in the construction of this section of superstructure:

Dimension stone in place.....	tons..	4,419.1
Rubblestone.....	do.....	1,421
Mortar.....	cubic yards..	25.9
Norway iron cramps in place.....	pounds..	785

A 3-inch solid-steel spindle for the support of a light, which the Light-House Establishment proposed to maintain, was erected on the outer end of the substructure of the breakwater.

Gloucester Harbor is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-houses are Ten-pound light, in the harbor, and Eastern Point light, at its entrance.

Money statement.

July 1, 1900, balance unexpended.....	\$24,625.27
June 30, 1901, amount expended during fiscal year	21,497.07
July 1, 1901, balance unexpended.....	3,128.20

{ Amount (estimated) required for completion of existing project	584,083.43
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	200,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

1050 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

APPROPRIATIONS.

Act of—		Act of—	
June 10, 1872.....	\$10,000	August 18, 1894	\$40,000
August 5, 1886	5,000	June 3, 1896	34,000
August 11, 1888	10,000	March 3, 1899	40,000
September 19, 1890	15,000		
July 13, 1892.....	40,000	Total	194,000

Contract in force during fiscal year ending June 30, 1901.

Contractor.	Price—					Entered into.	Approved.	Commence.	Complete.
	Per ton of 2,000 pounds, for rubblestone in substructure.	Per ton of 2,000 pounds, for dimension stone in superstructure.	Per ton of 2,000 pounds, for rubblestone in interior of superstructure and in apron.	Per cubic yard for mortar.	Per pound for Norway iron cramps in place.				
Rockport, Pigeon Hill, and Cape Ann Granite Cos., Rockport, Mass.	\$0.89	\$3.75	\$1.39	\$9.50	\$0.275	1899. Sept. 20	1899. Oct. 7	Within 30 days after notice of approval.	1900. Oct. 31

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Gloucester, Mass.

Amount of revenue collected.

1897.....	\$8,000
1898.....	6,079
1899.....	7,000
1900.....	7,780

Shipping.

	1897.		1898.		1899.		1900.	
	Num-ber.	Tons.	Num-ber.	Tons.	Num-ber.	Tons.	Num-ber.	Tons.
Entrances:								
Foreign	104	24,761	107	19,872	149	29,900	101	22,564
Domestic	10	14,400	28	4,000			30	1,850
Clearances:								
Foreign	102	25,400	103	16,563	120	13,500	99	11,312
Domestic	45	19,200	31	7,400	22	15,200	34	10,714

Shipments and receipts.

Articles.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal.....	47,200	60,000	70,000	60,400
Salt.....	26,200	23,500	27,000	31,575
Lumber.....	2,200	500	4,500	3,500
Fish (fresh and salt).....			70,000	70,000
Wood.....			2,122	
Merchandise.....	5,000	1,550	80,000	
Miscellaneous.....	2,000	500	30,000	100,000
Hay.....			200	
Brick.....			1,000	
Ice.....			2,500	
Iron.....				2,000
Total.....	82,600	86,050	287,922	267,475

During the calendar year 1900 3,639 vessels were boarded by the United States revenue officials. About 75,000 passengers were carried to and from Gloucester by steamer. Thirty schooners of about 100 tons each and one steamer of 132 tons were built in the vicinity during the year.

B 12.

IMPROVEMENT OF HARBOR AT MANCHESTER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 144.

No operations were in progress during the past fiscal year, and at the date of this report the condition of the improvement remained the same as on June 30, 1900.

Manchester Harbor is in the collection district of Gloucester, Mass., of which Gloucester is the port of entry. The nearest light-house is on Bakers Island, 2½ miles from Proctors Point.

Money statement.

July 1, 1900, balance unexpended	\$252.22
July 1, 1901, balance unexpended	252.22
{ Amount (estimated) required for completion of existing project	20,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 11, 1888	\$2,500
September 19, 1890.....	5,000
July 13, 1892.....	6,800
March 3, 1899.....	5,000
Total.....	19,300

The first three appropriations were expended in execution of the project of November 28, 1887.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
1899.....	10,000
1900:	
Coal.....	6,000
Lumber.....	3,000
Miscellaneous.....	3,000
Total.....	12,000

Arrivals and departures.

Barges, 8-foot draft, 200 tons capacity.....	30
Schooners, 7 to 8½-foot draft, 100 tons capacity.....	14
Steamers, 7 to 8-foot draft, 50 tons capacity.....	30
Miscellaneous, small draft, mostly yachts.....	276

Five small pleasure boats were built during the year.

B 13.

REPAIR OF SEA WALL AT MARBLEHEAD, MASSACHUSETTS.

A description of this work may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 145.

Nothing has been done and no funds expended during the past fiscal year.

This work is in the collection district of Marblehead, Mass., of which Marblehead is the port of entry. The nearest light-house is Marblehead Light, at the entrance to the harbor.

Money statement.

July 1, 1900, balance unexpended.....	\$991. 67
July 1, 1901, balance unexpended.....	991. 67

B 14.

IMPROVEMENT OF HARBOR AT BURLINGTON, VERMONT.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), until April 30, 1901.]

The improvement of this locality consists in forming an artificial harbor in front of the city by constructing a breakwater about 1,000 feet from the shore.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 146.

During the past fiscal year the old timber and stone superstructure of the breakwater adjoining and south of the section rebuilt with stone

in 1897 was removed for a distance of 140 feet and replaced with a superstructure of concrete. This work was done under contract during the low-water season of 1900. Work was suspended November 17, 1900, on account of cold weather, and was not resumed during the fiscal year, as the water in the lake had not subsided sufficiently. Under an allotment of \$5,000 from the emergency river and harbor act of June 6, 1900, some repairs that were urgently needed were made to the superstructure, which had been seriously damaged by storms; this work was not begun until late in the season and was suspended December 6 on account of cold weather.

With the unexpended balance it is proposed to continue the repair work and the replacement of the decayed superstructure with one of concrete as soon as the water in the lake is low enough to commence work. It is expected that all available funds will be expended before the close of the present working season.

Money statement.

July 1, 1900, balance unexpended.....	\$15,005.19
October 16, 1900, amount allotted from emergency river and harbor act approved June 6, 1900.....	5,000.00
	\$20,005.19
June 30, 1901, amount expended during fiscal year.....	6,517.49
July 1, 1901, balance unexpended.....	13,487.70
July 1, 1901, amount covered by uncompleted contracts.....	8,552.00
{ Amount (estimated) required for completion of existing project.....	219,605.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836.....	\$10,000.00	August 14, 1876.....	\$20,000.00
March 3, 1837.....	10,000.00	June 18, 1878.....	20,000.00
July 7, 1838.....	50,000.00	March 3, 1879.....	15,000.00
June 11, 1844.....	10,000.00	June 14, 1880.....	10,000.00
August 30, 1852.....	10,000.00	March 3, 1881.....	10,000.00
May 19, 1864.....	308.00	August 2, 1882.....	12,000.00
June 28, 1864.....	13,500.00	July 5, 1884.....	50,000.00
June 23, 1866.....	27,672.20	August 5, 1886.....	18,750.00
March 2, 1867.....	80,000.00	August 11, 1888.....	35,000.00
July 11, 1870.....	25,000.00	September 19, 1890.....	20,000.00
March 3, 1871.....	30,000.00	August 18, 1894.....	10,000.00
June 10, 1872.....	30,000.00	June 3, 1896.....	10,000.00
March 3, 1873.....	25,000.00	March 3, 1899.....	15,000.00
June 23, 1874.....	25,000.00	July 6, 1900.....	15,000.00
March 3, 1875.....	25,000.00		
		Total.....	622,230.20

NOTE.—In 1872 \$6,669.13 was carried to surplus fund and not expended.

¹ Allotment from emergency river and harbor act for repair work.

Contract in force during fiscal year ending June 30, 1901.

Contractor.	Removing old timber superstructure (about 465 linear feet), per linear foot.	Concrete footing blocks, in place, per cubic yard.	Concrete, in place, per cubic yard.	Hemlock timber and plank, in place, per 1,000 feet B. M.	Stone filling, in place, per cord of 128 cubic feet.	Entered into.	Approved.	Commence.	Complete.
Wm. James Daly, Ogdensburg, N. Y.	\$8.00	\$8.50	\$7.50	\$30.00	\$10.00	1899. Oct. 26	1899. Nov. 14	1899. Dec. 1	1900. Oct. 31 ¹

¹ Extended October 29, 1900, to October 31, 1901.

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Number.	Registered tonnage.	Trips made.
Steam	27	15 to 1,150	1,256
Sail	20	42 to 100	171
Canal boats and barges	298	60 to 162	639

Greatest length, 196 feet; greatest draft, 10 feet.

Freight handled.

Articles.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	44,597	43,352	39,236	76,762
Lumber and timber	36,342	36,702	23,334	21,003
Stone, gravel, and sand	2,079	11,281	8,249	11,298
General merchandise	26,162	25,192	16,811	22,163
Total	109,180	116,527	87,630	131,136.

Passengers carried, 152,989.

B 15.

IMPROVEMENT OF OTTER CREEK, VERMONT.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), until April 30, 1901.]

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part 1, page 148.

There were no operations in progress during the past fiscal year, and at the date of this report the condition of the improvement was the same as on June 30, 1900.

Money statement.

{ Amount (estimated) required for completion of existing project	\$11,248.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
June 10, 1872.....	\$10, 000	September 19, 1890.....	\$5, 000
March 3, 1875.....	5, 000	July 13, 1892.....	10, 000
June 18, 1878.....	8, 000	August 18, 1894.....	5, 000
March 3, 1879.....	5, 000	June 3, 1896.....	5, 000
June 14, 1880.....	2, 000	March 3, 1899.....	1, 000
March 3, 1881.....	2, 000		
August 2, 1882.....	2, 000	Total.....	62, 500
August 11, 1888.....	2, 500		

COMMERCIAL STATISTICS.

Vessels engaged in trade.

Class.	Number.		Tonnage.	Draft.
	1899.	1900.		
Steam.....	5	5	18 to 240	<i>Feet.</i> 5 to 8
Canal boats and barges.....	35	40	142 to 150	5 to 7

Freight handled.

Articles.	1896.	1897.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal.....	5, 000	5, 000	4, 700	5, 470
Lumber.....	2, 352	1, 080	600	600
Iron.....	800	1, 050	900	1, 000
Kaolin.....	450	300	500	520
General merchandise.....	450	250	500	500
Total.....	9, 052	7, 680	7, 200	8, 090

Number of passengers carried during calendar year ending December 31, 1900, 6,172.

B 16.

IMPROVEMENT OF NARROWS OF LAKE CHAMPLAIN, NEW YORK AND VERMONT.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), until April 30, 1901.]

This improvement consists in widening and deepening the channel from Whitehall, N. Y., the northern terminus of the Champlain Canal, to Benson Landing, Vt., a distance of 15 miles.

Under various appropriations a depth of 12 feet in this channel has been made, with a width of 150 feet; but during suspension of work a shoaling occurred until there was only about 10 feet available for navigation.

The approved project and the report of progress of the work to June 30, 1900, may be found in the Annual Report of the Chief of Engineers for 1901, Part I, page 148.

In July, 1900, it was reported by the navigation interests that a

shoal had formed in Whitehall Harbor which was a serious obstruction to navigation at that place, and on July 31, 1900, an allotment of \$1,500 was made for its removal from the emergency river and harbor act of June 6, 1900. The work was done in September, 1900, restoring the area dredged to its former depth of approximately 12 feet. A total of 2,910 cubic yards of material was removed. No other operations were in progress during the year.

Money statement.

July 1, 1900, balance unexpended	\$74.09	
July 31, 1900, amount allotted from emergency river and harbor act approved June 6, 1900	1,500.00	
		\$1,574.09
June 30, 1901, amount expended during fiscal year		1,574.09
{ Amount (estimated) required for completion of existing project		17,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....		17,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

APPROPRIATIONS.

Act of—		
August 5, 1886	\$30,000	
August 11, 1888	15,000	
July 13, 1892	18,500	
March 3, 1899	5,000	
June 6, 1900.....	1,500	
Total		70,000

COMMERCIAL STATISTICS.

Amount of freight passing through the Narrows of Lake Champlain.

Articles.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Timber and lumber.....	93,181	100,806	134,496	99,235
Pulp, wood.....	148,183	125,656	141,316	238,834
Salt.....	2,340	2,375	2,014	1,476
Sugar and molasses	2,354	152	1,839	916
Coal.....	156,604	159,558	218,480	203,670
Stone, lime, and clay.....	19,414	19,178	31,652	25,112
Iron ore.....	64,767	59,687	199,590	98,696
General merchandise	33,030	31,319	119,070	46,802
Total.....	519,873	498,731	848,457	714,741
Number of boats passing through the Narrows	3,724	3,485	5,502	4,501

¹ Allotment from emergency river and harbor act.

B 17.

EXAMINATION AND SURVEY OF HENDERSONS POINT, PORTSMOUTH HARBOR, NEW HAMPSHIRE.

[Printed in House Doc. No. 263, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 28, 1900.

SIR: I have the honor to submit the accompanying copies of reports, dated August 27 and December 21, 1900 (with map and a sheet of cross sections), the former by Maj. W. L. Fisk, Corps of Engineers, upon preliminary examination, and the latter by Capt. Harry Taylor, Corps of Engineers, upon survey, required by the provisions of the emergency river and harbor act of June 6, 1900, of Hendersons Point, Portsmouth Harbor, New Hampshire, with a view of removing a portion of said point for the purpose of improving navigation to the navy-yard.

From these reports and the accompanying papers it appears that the proposed improvement is not needed in the interests of commerce, but is considered very essential in order to permit the larger ships of the Navy to pass freely to the new dry dock, located at the Portsmouth Navy-Yard.

The cost of the necessary work is estimated by Captain Taylor at \$800,000 if funds are made available for carrying on the work continuously. For the reasons given, this estimate is increased to \$1,180,000 if the work be not prosecuted under a single contract.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF HENDERSONS POINT, PORTSMOUTH HARBOR, NEW HAMPSHIRE, WITH A VIEW TO REMOVING A PORTION OF SAID POINT FOR THE PURPOSE OF IMPROVING NAVIGATION TO THE NAVY-YARD.

UNITED STATES ENGINEER OFFICE,
Portsmouth, N. H., August 27, 1900.

GENERAL: In compliance with instructions contained in your letter of June 13, 1900, I have the honor to submit the following report of preliminary examination of Hendersons Point, Maine, Portsmouth Harbor, New Hampshire, with a view of removing a portion of said point for the purpose of improving navigation to the navy-yard.

The channel makes at this place an abrupt turn of 60 degrees, and Hendersons Point narrows the available width to about one-half what it is immediately above and below, makes the tidal currents excessive, and renders it extremely difficult to handle vessels of the size to be

accommodated by the new dry dock at the navy-yard, the entrance to which is less than 700 yards above the point.

The removal of all or a portion of the point would greatly facilitate access to the dry dock. In order to make an estimate of the cost a survey in great detail will be necessary, and while covering but a small area, it will cost about \$750, as the tidal currents are so strong it will only be possible to work at and near slack water. There being no available balance from former appropriations, the allotment of this amount from the act of June 6, 1900, is requested.

Very respectfully, your obedient servant,

W. L. FISK,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[Third indorsement.]

U. S. ENGINEER OFFICE,
Portsmouth, N. H., September 5, 1900.

Respectfully returned to the Chief of Engineers.

This improvement is not required by the commercial interests of this port, as vessels of the size handling the local commerce (which is almost entirely coal) have little or no difficulty coming up to the city wharves.

The only question involved is that of the requirements of the naval service, upon which I am not prepared to express any opinion beyond that given in my report, as I have had no experience in connection with the handling of large vessels of naval types.

There is ample depth of water in the channel at the lowest water for the largest vessel in the world, and at slack water, either high or low, I presume naval vessels could be handled with little trouble; but at any other times there are terrific currents and eddies which must make the handling of very heavy ships extremely difficult and, I judge, dangerous, as the channel is very narrow, with banks of solid rock on both sides.

W. L. FISK,
Major, Corps of Engineers.

[Fourth indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, September 6, 1900.

Respectfully returned to the Chief of Engineers.

By the preceding indorsement it appears that the improvement is not worthy of being made by the United States for the benefit of "the commercial interests" of the port. As regards the naval interests of the port, attention is invited to copies of a correspondence between this office and the officer commanding the Kittery Navy-Yard, June 16 and 19, 1899, relative to the necessity for widening the channel at Seavys Island by an improvement on the right bank of the river opposite Hendersons Point.

The language of the naval commander is very guarded, and it is

assumed that he would have recommended the improvement in unmistakable terms had he deemed it necessary for naval purposes.

In view of the foregoing the improvement is not recommended.

G. L. GILLESPIE,
*Colonel, Corps of Engineers,
Division Engineer.*

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 25, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Hendersons Point (Maine), Portsmouth Harbor, New Hampshire (full text of item given within), required by the provisions of the emergency river and harbor act of June 6, 1900.

The local and division engineers are of opinion, expressed in third and fourth indorsements hereon, that the proposed improvement is not required by the commercial interests of the port.

Attention is respectfully invited to the accompanying letter, dated the 22d instant, to the Secretary of War by the Secretary of the Navy, who quotes and concurs in opinion of the Chief of the Bureau of Yards and Docks, Navy Department, that it is—

very necessary that navigation at the point named should be improved on account of its value to the naval service. If this be not done the dry dock referred to will not be available for a large number of the most important vessels of the naval service, and the usefulness of the yard will be largely impaired.

In view of this opinion of the Secretary of the Navy, I recommend that the local officer be directed to make a survey, estimated to cost not more than \$750, and to prepare a plan and estimate of cost of improvement required.

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

[Sixth indorsement.]

WAR DEPARTMENT,
October 26, 1900.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War: .

JOHN C. SCOFIELD,
Chief Clerk.

LETTER OF COL. G. L. GILLESPIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, N. Y., June 16, 1899.

SIR: The river and harbor act approved March 3, 1899, contains an item for a survey of "Pull-and-be-damned Point, Portsmouth Harbor," with a view to its removal, so far as the same is an obstruction to navigation.

I have the honor to request to be informed if this item was inserted at the suggestion of the Navy Department for the purpose of facilitating the navigation of the harbor in its relation to the navy-yard and of the special necessity for this improvement.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Colonel, Corps of Engineers,
Division Engineer, Northeast Division.*

The COMMANDING OFFICER,
U. S. Navy-Yard, Portsmouth, N. H.

LETTER OF REAR-ADMIRAL GEORGE C. REMEY, UNITED STATES NAVY.

UNITED STATES NAVY-YARD,
Portsmouth, N. H., June 19, 1899.

SIR: In reply to your letter of the 16th instant, received at my office during an absence from this yard, I have the honor to inform you that I have no knowledge whatever as to who suggested the item for a survey of "Pull-and-be-damned Point, Portsmouth Harbor," river and harbor act approved March 3, 1899.

2. The removal of a portion of Pull-and-be-damned Point has long been a topic of public discussion in the local press.

Very respectfully,

GEO. C. REMEY,
*Rear-Admiral, United States Navy,
Commandant Navy-Yard and Station.*

Col. G. L. GILLESPIE,
*Corps of Engineers, Division Engineer, Northeast Division,
Army Building, New York, N. Y.*

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, September 10, 1900.

SIR: The emergency river and harbor act approved June 6, 1900, makes provision for a preliminary examination of Hendersons Point, Portsmouth Harbor, New Hampshire, with a view of removing a portion of said point for the purpose of improving navigation to the navy-yard. The act also calls for a survey, with plan and estimate of improvement proposed, provided the locality is deemed to be worthy of improvement by the United States.

I am just in receipt of the report of the preliminary examination at Hendersons Point, and the local officer, Maj. W. L. Fisk, Corps of Engineers, states as follows:

This improvement is not required by the commercial interests of this port, as vessels of the size handling the local commerce (which is almost entirely coal) have little or no difficulty coming up to the city wharves.

The only question involved is that of the requirements of the naval service. * * *

There is ample depth of water in the channel at the lowest water for the largest vessel in the world, and at slack water, either high or low, I presume naval vessels could be handled with little trouble; but at any other times there are terrific currents and eddies which must make the handling of very heavy ships extremely difficult and, I judge, dangerous, as the channel is very narrow, with banks of solid rock on both sides.

The Division Engineer, Col. G. L. Gillespie, Corps of Engineers, in forwarding Major Fisk's report, states that—

By the preceding indorsement it appears that the improvement is not worthy of being made by the United States for the benefit of "the commercial interests" of the port. As regards the naval interests of the port, attention is invited to copies of a correspondence between this office and the officer commanding the Kittery Navy-Yard, June 16 and 19, 1899, relative to the necessity for widening the channel at Seavys Island by an improvement on the right bank of the river, opposite Hendersons Point. The language of the naval commander is very guarded, and it is assumed that he would have recommended the improvement in unmistakable terms had he deemed it necessary for naval purposes.

In view of the foregoing the improvement is not recommended.

In order that a correct conclusion may be reached as to the propriety and necessity for a survey under the terms of the act, I recommend that the Secretary of the Navy be requested to state whether in his judgment the requirements of the naval service demand that a portion of Hendersons Point, Portsmouth Harbor, shall be removed for the purpose of improving navigation to the navy-yard at Portsmouth, N. H.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

WAR DEPARTMENT,
September 14, 1900.

Respectfully referred to the honorable the Secretary of the Navy, with request that the information desired by the Chief of Engineers be furnished, if practicable.

G. D. MEIKLEJOHN,
Acting Secretary of War.

LETTER OF THE SECRETARY OF THE NAVY.

NAVY DEPARTMENT,
Washington, October 22, 1900.

SIR: Referring to your indorsement of the 14th ultimo on the letter of Brig. Gen. John M. Wilson, Chief of Engineers, U. S. A., requesting the views of this Department as to whether the requirements of the naval service demand that a portion of Hendersons Point, Portsmouth Harbor, shall be removed for the purpose of improving navigation in the navy-yard at Portsmouth, N. H., I have the honor to inform you that the Chief of the Bureau of Yards and Docks, to whom the letter of the Chief of Engineers was referred, has submitted the following report, in which the Department concurs:

The Bureau has given careful consideration to the subject of the removal of a portion of Hendersons Point, Portsmouth Harbor, and has received a copy of the correspondence referred to by Colonel Gillespie. In this correspondence the commandant

of the station made no recommendation in the matter, but the Bureau does not regard that as conclusive that he did not consider such an improvement desirable or even necessary.

The navigation of this portion of the channel, which is between the Portsmouth Navy-Yard and the lower harbor, is well known to be difficult, if not dangerous, for the large battle ships of the Navy. The current at this point is exceedingly swift, except immediately at the turn of tide. As a matter of fact, none of the battle ships have passed up to the Portsmouth Navy-Yard, the commanders of these vessels preferring to undergo the inconvenience of retaining the ships in the lower harbor and receiving coal and other supplies by lighters rather than incur the risks of passing through the channel at Hendersons Point.

The Government has under construction at this navy-yard one of the largest dry docks recently authorized by Congress, which was required to be not less than 700 feet in length and evidently intended to fit this yard for handling in dock the largest vessels in the service.

The Bureau considers it very necessary that navigation at the point named should be improved on account of its value to the naval service. If this be not done, the dry dock referred to will not be available for a large number of the most important vessels of the naval service and the usefulness of the yard will be largely impaired.

Very respectfully,

J. D. LONG,
Secretary.

The Honorable the SECRETARY OF WAR.

SURVEY OF HENDERSONS POINT, PORTSMOUTH HARBOR, NEW HAMPSHIRE,
WITH A VIEW TO REMOVING A PORTION OF SAID POINT FOR THE PURPOSE OF IMPROVING NAVIGATION TO THE NAVY-YARD.

UNITED STATES ENGINEER OFFICE,
Portsmouth, N. H., December 21, 1900.

GENERAL: In compliance with instructions contained in your letter of October 30, 1900, I have the honor to submit the following report of a survey of Hendersons Point (Maine), Portsmouth Harbor, New Hampshire, "with a view of removing a portion of said point for the purpose of improving navigation to the navy-yard."

Under date of August 27, 1900, Maj. W. L. Fisk, Corps of Engineers, submitted a report of a preliminary examination of this point. In this report it was stated that—

The channel makes at this place an abrupt turn of 60 degrees, and Hendersons Point narrows the available width to about one-half what it is immediately above and below, makes the tidal currents excessive, and renders it extremely difficult to handle vessels of the size to be accommodated by the new dry dock at the navy-yard, the entrance to which is less than 700 yards above the point. The removal of all or a portion of the point would greatly facilitate access to the dry dock.

And in third indorsement on the same report, dated September 5, 1900, Major Fisk further stated that—

This improvement is not required by the commercial interests of this port, as vessels of the size handling the local commerce (which is almost entirely coal) have little or no difficulty coming up to the city wharves.

The only question involved is that of the requirements of the naval service, upon which I am not prepared to express any opinion beyond that given in my report, as I have had no experience in connection with the handling of large vessels of naval types.

There is ample depth of water in the channel at the lowest water for the largest vessel in the world, and at slack water, either high or low, I presume naval vessels could be handled with little trouble; but at any other times there are terrific currents and eddies which must make the handling of very heavy ships extremely difficult and, I judge, dangerous, as the channel is very narrow, with banks of solid rock on both sides.

The map¹ which is forwarded herewith is the result of a very careful survey, and the estimate of the quantities to be removed is believed to be very close. It is estimated that if sufficient money is available to carry on the improvement continuously the point can be removed to a depth of 30 feet below mean low water for a distance of 330 feet, measured from the high-water line, and that the work can be accomplished in about three years, at an estimated cost of \$800,000, but that if appropriations are not sufficient to carry on the work continuously the estimated cost will be \$1,180,000. The detailed reasons for the difference in these two estimates are given in the report of Assistant Engineer W. F. Robinson, a copy of which is forwarded herewith.

It does not appear from the records of this office that there has ever been any complaint made by the commercial interests that this point is an unreasonable obstruction to navigation or that its removal is a necessity in the interests of the commerce which now seeks this port, and in my opinion the benefit to commerce which would result from its removal is not sufficient to justify the cost. I am not prepared to give an opinion as to the benefit to the Navy.

A letter from the collector of customs, dated March 13, 1900, forwarding commercial statistics for the calendar year ending December 31, 1899, together with its inclosure, is also forwarded herewith. It will be observed that over 93 per cent of the tonnage of imports is coal and that the balance consists of materials which are of comparatively small value.

Very respectfully, your obedient servant,

HARRY TAYLOR,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, December 24, 1900.

Respectfully forwarded to the Chief of Engineers, concurring in the views of the district officer.

The proposed improvement is not required by the commercial interests of the port, but in view of the opinion expressed by the Secretary of the Navy that the improvement is very necessary in relation to the use by naval ships of the dry dock located at the Kittery Navy-Yard, I have the honor to recommend the locality as worthy of improvement by the United States at the estimated cost of \$800,000.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

¹Not printed. A portion of this map was printed in House Doc. No. 263, Fifty-sixth Congress, second session.

REPORT OF MR. W. F. ROBINSON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Portsmouth, N. H., December 21, 1900.

CAPTAIN: I have the honor to submit herewith map¹ (in two sheets) of the recent survey of Hendersons Point, Maine, Portsmouth Harbor, New Hampshire, together with an estimate of the cost of the removal of same.

The whole point is solid ledge covered with a thin covering of earth. For the purpose of this estimate it has been considered all ledge. The point has been divided into four sections on the drawing with the quantities in cubic yards in each section. Sections I, II, and III, the removal of which would increase the width of the channel about 50 per cent at this point, contain 195,814 cubic yards, and the following estimate is based on the assumption that a single contract for the removal of the three sections will be made.

The time required to complete the work from time of commencement will probably be three years, and one-third of the total cost of the work could be used each year.

The estimated price for removing the ledge and wasting it in the coves on either side of the point is placed at \$3.88+ per cubic yard. The estimate is based on the plan of using a cofferdam, which is believed to be the most economical way of doing the work, and the following items enter into the estimate:

Removing 16,000 cubic yards of ledge to make a foundation for the dam, at \$10 per cubic yard	\$160,000
Building 1,400 feet of cofferdam and filling same with ballast	140,000
Plant, pumping, and maintenance of the dam for the time the work is in progress	50,000
Removal of cofferdam after ledge is removed	20,000
Drilling, blasting, and removing 195,814 cubic yards of ledge, at \$2 per cubic yard	391,628
Engineering expenses and contingencies	38,372
Total	800,000

Under the proposal to remove small portions under any one contract, the estimated cost is as follows: To remove the portion of ledge in the three sections, I, II, and III, which lies above the plane of mean low water, 49,911 cubic yards, at \$2 per cubic yard, \$99,822, which can be done with derricks and cars. The remaining portion below that plane would be subaqueous work, 145,903 cubic yards, at \$7, = \$1,021,321. It will not be practicable to use a cofferdam for the work under this proposition, so the removal would have to be done by drilling and blasting under water and the material excavated by means of dredges. As the current is very rapid at this point, \$7 per cubic yard is not thought to be an excessive price.

Recapitulation.

Removing ledge which lies above the plane of mean low water, 49,911 cubic yards, at \$2	\$99,822
Removing ledge which lies below the plane of mean low water, 145,903 cubic yards, at \$7	1,021,321
Contingencies, etc	58,857
Total	1,180,000

Respectfully submitted.

W. F. ROBINSON,
Assistant Engineer.Capt. HARRY TAYLOR,
Corps of Engineers.

LETTER OF MR. RUFUS N. ELWELL, COLLECTOR OF CUSTOMS AT PORTSMOUTH, N. H.

OFFICE OF THE COLLECTOR OF CUSTOMS,
Port of Portsmouth, N. H., March 13, 1900.

SIR: The figures in inclosed form relative to imports are approximate. As nearly all vessels entering this port with cargo arrive from American ports on the North Atlantic seaboard, they are not required to produce manifests of cargoes at custom-house.

¹ Not reprinted; printed in House Doc. No. 263, Fifty-sixth Congress, second session.

With the exception of foreign coal that is imported in British steamers of about 20 feet draft, about all the coal that arrives here is brought by sailing vessels and barges of large tonnage, from 15 to 25 feet draft.

A large number of sailing vessels of small tonnage, of 10 feet draft, bring building sand, stone, molding sand, fertilizer, cement, etc., most of which goes up country to manufacturing towns. Some of these vessels load here with leather scrap, hay, cord wood, etc.

Some years there are received a great many thousand railroad ties in vessels from British provinces; last year there were very few, which makes foreign entrances and clearances smaller than usual.

There is some clay shipped from up-river banks, but the exports consist almost entirely of bricks, of which about twenty to twenty-five million are shipped annually.

Respectfully, yours,

RUFUS N. ELWELL,
Collector.

Maj. W. L. FISK,
Corps of Engineers.

Commercial statistics for Portsmouth Harbor, New Hampshire, for the calendar year ending December 31, 1899.

ENTRANCES AND CLEARANCES.

[Amount of revenue collected during the year, \$16,070.25.]

	Number.	Tonnage.
Entrances:		
Foreign	14	8,824
Coastwise	943	313,568
Clearances:		
Foreign	25	13,950
Coastwise	900	310,000

IMPORTS AND EXPORTS.

	Imported.	Exported.
	<i>Tons.</i>	<i>Tons.</i>
Coal	350,000	.....
Iron	1,700	.....
Stone	10,000	.....
Sand	3,000	.....
Lumber	6,000	.....
Salt	800	.....
Lime, cement, and plaster	1,600	.....
Fertilizer	2,000	.....
Clay	700	6,000
Bricks .....	.....	58,000
Merchandise .....	.....	500

B 18.

EXAMINATION AND SURVEY OF BEVERLY HARBOR, MASSACHUSETTS.

[Printed in House Doc. No. 129, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 30, 1900.

SIR: I have the honor to submit herewith copies of reports dated August 13, 1900, and November 20, 1900, by Maj. W. L. Fisk, Corps of Engineers, giving the results of preliminary examination and

survey, respectively, authorized by the emergency river and harbor act approved June 6, 1900, of Beverly Harbor, Massachusetts, "with a view to the straightening, widening, deepening, and otherwise improving the entrance to the harbor and the approaches to the wharves and docks therein."

From a survey made in 1889, it was found that Beverly Harbor possessed an available channel of 18 feet depth at mean low water to the wharves of the town, but the claim has been made that this channel has deteriorated materially. The present survey shows that while no material shoaling has taken place, the width of the 18-foot channel is so narrow at certain points as to make it quite difficult to take heavy coal vessels through without touching on one side or the other.

In order to give a clear channel width of 200 feet at low water, Major Fisk recommends a limited amount of dredging, estimated to cost \$10,000, and states that to this extent the locality is worthy of improvement by the General Government. The views of the local officer are concurred in by the division engineer, Col. G. L. Gillespie, Corps of Engineers.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF BEVERLY HARBOR, MASSACHUSETTS,
WITH A VIEW TO THE STRAIGHTENING, WIDENING, DEEPENING, AND
OTHERWISE IMPROVING THE ENTRANCE TO THE HARBOR AND THE
APPROACHES TO THE WHARVES AND DOCKS THEREIN.

UNITED STATES ENGINEER OFFICE,
Portsmouth, N. H., August 13, 1900.

GENERAL: In compliance with instructions contained in your letter of June 13, 1900, I have the honor to submit the following report of preliminary examination of Beverly Harbor, Massachusetts, "with a view to the straightening, widening, deepening, and otherwise improving the entrance to the harbor and the approaches to the wharves and docks therein:"

The harbor is fully described in the Annual Report of the Chief of Engineers for 1890, page 524, and is of considerable importance. A survey was made in 1889 and showed an available channel of 18 feet depth at mean low water to the wharves of the town. The claim is now made that this channel has shoaled materially and so narrowed up in places that vessels drawing as little as 12 or 14 feet get aground in it.

The facts as to existing circumstances can only be determined by a resurvey, which I recommend be made and which will cost \$500. There being no available balance from former appropriations, the allotment of this amount from the act of June 6, 1900, is requested. The data furnished by the survey will determine whether or not improvement should be undertaken. The commerce now interested in this harbor

greatly exceeds that at the time the 1889 survey was made, and in my opinion the harbor is worthy of restoration if the results of the proposed survey show that the channel has contracted and shoaled to the extent claimed by those interested in the improvement.

Very respectfully, your obedient servant,

W. L. FISK,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, August 14, 1900.

Respectfully forwarded to the Chief of Engineers, concurring in the views of the district officer.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 17, 1900.

Respectfully submitted to the Secretary of War.

This report relates to a preliminary examination of Beverly Harbor, Massachusetts (full text of item given within), required by the emergency river and harbor act of June 6, 1900.

In 1889 there was an available channel of 18 feet depth at mean low water to the wharves of the town, but it is now claimed that vessels drawing 12 or 14 feet ground in the channel.

The local officer is of opinion, concurred in by the division engineer, that the harbor is worthy of restoration if the results of the proposed survey show that the channel has contracted and shoaled to the extent claimed by those interested in the improvement.

I recommend that a survey of the harbor be authorized in accordance with the views of the local and division engineers.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
August 18, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

SURVEY OF BEVERLY HARBOR, MASSACHUSETTS, WITH A VIEW TO OBTAINING A CHANNEL 200 FEET WIDE AND 18 FEET DEEP AT MEAN LOW WATER.

UNITED STATES ENGINEER OFFICE,
Portsmouth, N. H., November 20, 1900.

GENERAL: In compliance with instructions contained in Department letter of August 24, 1900, I have the honor to report as follows upon the survey of Beverly Harbor, Massachusetts, made under the provisions of the river and harbor act of June 6, 1900:

The harbor is fully described in the Annual Report of the Chief of Engineers for 1890, page 524. As stated in my report of August 13, 1900, upon the preliminary examination of this harbor, it was claimed that the channel of 18 feet depth at mean low water, shown by the survey of 1889, had shoaled to depths of 12 or 14 feet.

The present survey, however, made during September, 1900, (tracing herewith¹) shows that there has been no shoaling whatever, and agrees with that of 1889 to such a remarkable degree that it is worthy of special notice.

The width of the 18-foot channel is shown to be so narrow, however, at the sharp turn between Tucks Point and Salem Willows as to make it quite difficult to take the heavy coal vessels through without touching on one side or the other.

It is therefore recommended that a small amount of dredging, estimated at 18,230 cubic yards, be done at the places indicated on the chart in order to give a clear channel width of about 200 feet between the curves of 18-foot depths at mean low water. As this work will be merely trimming along the edges of the channel, and as a contractor must haul out to allow vessels to pass, the cost is estimated at 50 cents per yard, or—

18,230 cubic yards, at 50 cents.....	\$9, 115
Contingencies, etc., about 10 per cent.....	885
Total	10, 000

Some of the coal barges entering draw 16 to 17 feet with an occasional vessel of 20 to 22 feet draft. As there is an average rise and fall of tide of 9.2 feet the latter vessels would suffer very little delay.

Although the value and importance of reliable and complete commercial statistics were very strongly urged upon those present at the hearing held in Beverly on August 6 last, the only ones I have been able to obtain will be found in Mayor Webber's letter of November 5, 1900, and its inclosure (copies herewith), and are of little value in determining whether or not this harbor is worthy of improvement.

I am, however, of the opinion that Beverly Harbor is worthy of improvement by the General Government as indicated in the above estimate, and to that extent only.

Very respectfully, your obedient servant,

W. L. FISK,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

¹Not printed.

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, November 23, 1900.

Respectfully forwarded to the Chief of Engineers, concurring in the views and recommendations of the district officer.

G. L. GILLESPIE,
*Colonel, Corps of Engineers,
 Division Engineer.*

LETTER OF MR. BENJAMIN D. WEBBER, MAYOR OF BEVERLY, MASS.

CITY OF BEVERLY, MASS., EXECUTIVE DEPARTMENT,
City Hall, November 5, 1900.

DEAR SIR: Referring to your communication of the 3d ultimo, relative to the proposed improvement of Beverly Harbor, I think you will appreciate that, in the absence of a statistical bureau connected with the local trade organization, it is a somewhat difficult matter to procure in proper form from the individual dealers in water-borne commodities such detailed information as mentioned in your letter.

All of our people have the desire to respond to requests of the kind and are keenly alive to the necessity of, and deeply interested in, the proposed improvement of our harbor.

The hearing you so kindly granted, at which many of our leading business men were present, will have no doubt convinced you that it is their universal opinion that the needs of commerce require the deepening and straightening of the channel and harbor.

The intention to furnish the data requested is undoubted, but I regret to find that it has come to me in a shape to make it impossible for me to so compile it as to cover the calendar year 1899 unless granted a little more time for further correspondence with the dealers. For instance, I find that the statement last received on November 1 instant does not separate by months the tonnage during the period from April, 1898, to April, 1900, although a previous statement received from the same party last year gave the tonnage handled by him for a period of twelve months. I am therefore able to furnish you with data as to coal received by water during the twelve months from April, 1898, to April, 1899, and trust that this period of time is sufficiently recent to fully answer your purpose. It is as follows:

Number of vessels	69
Number of tons	39,569
Value	\$134,569.44

I think it a perfectly safe statement to make that the quantity and value of coal received at this port during the calendar year 1899 was considerably in excess of the above, and in a growing community like ours will continue to increase from year to year with our industrial development and increasing population.

Coal has been transported in vessels of a draft for the most part of 16 to 17 feet, although in one or two instances vessels drawing 20 to 22 feet have with perhaps some difficulty been navigated and docked.

Lumber.—Our principal dealers in lumber inform me that in 1898 they received by water 40 cargoes, consisting of 3,639,711 feet lumber, 4,600,000 shingles, 587,000 laths, of an approximate value of \$70,000; and in 1899, 58 cargoes, consisting of 5,508,902 feet lumber, 2,853,000 shingles, 1,284,900 laths, 3,124 posts, and 11,000 pickets, at an approximate value of \$110,000.

This lumber is partly product of State of Maine shipped from provincial ports free of duty, partly shipped from Southern ports, such as Norfolk, Pensacola, and Brunswick (Ga.), such heavier cargoes being usually transported in three-masted vessels. The firm in question also paid duties on foreign lumber of about \$1,200 in 1898 and over \$1,300 in 1899. They remark in a letter to me on the subject: "We have at times been considerably inconvenienced by being obliged to look for vessels of comparatively light draft, and such vessels, particularly from the South, command a higher freight rate than larger boats."

Another party lands perhaps 100,000 feet lumber per year, value unascertained. As nearly as I can ascertain, there is also landed by vessels at this port not less than

8,000 casks lime yearly, besides varying quantities of sand, brick, stone, salt, fire-wood, cement, and iron pipe, all of which aggregate a considerable tonnage.

In 1898 there was also handled not less than 1,300,000 pounds fish, and it is hoped that the fishing industry may continue to grow and become one of our large and permanent industries.

All of the above is exclusive of the lumber, coal, and oil tonnage entering Beverly Harbor and destined to Danvers or North Salem. From a source that I deem perfectly reliable I have procured the following:

Number of vessels and tonnage entering port of Beverly.

Year ending—	Schooners.	Sloops.	Barges.	Brigs.	Total.	Tonnage.
June 30, 1895	96	2	6	1	105	23,297
December 31, 1898	306	7	16	.....	329	47,590

Yachts and vessels of less than 20 tons are not included in the above.

During the present year the largest barge entering port appears to have been the *Passaic*, bringing 1,596 tons coal, draft $16\frac{1}{2}$ feet, and the largest schooner the *Percy Birdsall*, bringing 1,750 tons coal, draft 20 feet.

The commerce of the port is nearly all coastwise, there being, however, as previously stated herein, some importations of lumber from the maritime provinces. Vessels, with the exception of an occasional small coal steamer, are sailing vessels and coal barges.

There are no regular lines of transportation. The commerce of the port is carried on by chartered vessels wholly. It occurs to me to inclose for your perusal and return a report received by me on August 31, 1899, from a joint committee of Beverly Board of Trade and Jubilee Yacht Club relative to the subject in question.

Of course, having made a comprehensive survey of our harbor, the charts referred to in the report would probably be of no especial value to you, and for that reason I do not send them. I think there is subject-matter in the report, however, that will be of interest.

I think it unnecessary for me to add anything to what was said at the hearing in Beverly, which it seems to me clearly brought out the fact that those most interested in the commerce of Beverly, as well as our city government and the people generally, are convinced that the harbor is worthy of improvement; that our growing commerce requires its improvement, and that in competition with manufacturing places having better harbors we must have ours improved in order to increase our industries and hold our own commercially. I can but anticipate that your investigation and the facts elicited will warrant a report to the War Department favorable to the proposed improvement, in which I can assure you all of our people are deeply interested.

I desire in behalf of those interested and for myself to thank you for your courtesies in granting a hearing upon the subject and for your interest therein.

Yours, very truly,

BENJAMIN D. WEBBER, *Mayor.*

Maj. W. L. Fisk,
Corps of Engineers.

REPLY OF THE JOINT COMMITTEE OF THE BEVERLY (MASS.) BOARD OF TRADE AND THE JUBILEE YACHT CLUB, DATED AUGUST 31, 1899, TO QUESTIONS 2 AND 3 IN LETTER DATED AUGUST 28, 1899, OF MR. B. D. WEBBER, MAYOR OF BEVERLY.

Question No. 2. "What is the present condition of the harbor?"

Chart.—The chart, to which reference is made and which is attached, is an official chart, No. 244, and signified by me for reference as No. 244 A to distinguish from the chart sent you in connection with letter to you August 25, 1899.

In regard to this chart I would respectfully submit that the soundings of $3\frac{3}{4}$ and 4 fathoms in the upper harbor are incorrect. Have designated these by red lines leading to the letter "S" on chart. There is an average of 14 feet only at mean low water in the most favorable channel that towboat captains can "pick out," and of course much less as a general rule.

Channel.—The channel from Bar Head beacon to the wharves, as explained further on, is very narrow and surrounded by shoals, which makes navigation difficult and

prohibitory at anything less than high water. Draft of vessels, etc., explaining this given in answer to question No. 3.

Within red lines marked "A."—At Lobster Rock beacon channel is very narrow and should be widened full width.

Approach to bridges is also quite shoal.

Within red lines marked "B."—At entrance to the harbor a shoal has formed, as represented on the chart, or it may have always been a shoal spot; at the present time vessels are grounding there where they passed in safety only two years ago. Being at the beginning and in a spot where vessels must be turned to run in the narrow channel up the "Bar Reach," it is a bad obstruction to navigation.

Again, farther along past $4\frac{1}{2}$ fathoms' sounding, as represented on chart No. 244 A, the channel is extremely narrow; in fact, so narrow that a coal-laden vessel, draft 22 feet, can not vary her course the beam of the vessel without grounding.

At red buoy No. 4 (chart 244 A), where sounding is represented as 8 feet, there is a large rock the size of a pilot house on a towboat.

Passing red buoy No. 4 and arriving at $4\frac{1}{2}$ fathoms, as represented on chart 244 A, it will be noticed that you are obliged to turn red buoy No. 6 at this point, and the width of the channel is such that towboat captains say they very rarely escape touching deep-draft vessels at this point.

After passing red buoy No. 6 shoal water is encountered to the wharves and bridges, more particularly on spot marked "X" on chart 244 A, where deep-draft vessels are practically blocked.

[Replying to letter of August 28, Mayor B. D. Webber, city of Beverly, Mass., to A. A. Forness, secretary joint committee, harbor improvements.]

Question No. 3. "What are the prospective demands of the commerce of Beverly, and to what extent and in what manner, in my opinion and that of others interested, is the improvement of the harbor necessary in order to meet such prospective demands?"

Chart.—Reference in the following will be applied to chart No. 244 B. And in regard to the charts—the Government officials will in all probability refer to their charts—and if, as I understand, these charts as referred to in these papers are official charts, an injustice will certainly be done Beverly Harbor in the matter of "improvements" if they are too closely followed.

Draft.—The "prospective demands," in my estimation, can only be determined by conditions and progress in building carriers for the coast commerce of the country; that is, in reference to the draft of water required to accommodate vessels in the future.

The large vessels and barges now demand a depth of 22 feet for the former, and what is called "built barges," 16 to 18 feet, and "barges that are really 'old ships'" a draft of 20 feet, or, say, up to 25 and 26 feet.

An increase of 6 feet in draft has taken place during the last ten years, the probabilities being that it will be much less the next ten. However, the tendency of shipping is toward large carriers and reduced freights.

Vessels entering Beverly.—The cargoes brought by different vessels will be given you, undoubtedly, in answer to question No. 1, and I will simply say under this head that they range from a schooner of about 80 tons to four-masted vessels and barges carrying upward of 1,200 tons of coal, with a draft of 22 feet; and in this connection it would be well to call the attention of the officer having this matter in charge to the difficulty in turning one of these large vessels in the narrow channel almost the entire distance up the harbor.

It would seem that if the present demands of commerce were provided for it would answer for quite a term of years, as instanced by the fact that nearly, or more, than fifty years have elapsed since anything was done to the harbor.

Increase of commerce.—The imports of Beverly Harbor are said to have increased 33 per cent in the last ten years, and as Beverly is a distributing point for many towns inland it would seem as though this ratio would be more than maintained in the future, to say nothing of the local increase which increased industries will necessarily demand.

B 19.

REPORT ON CONDITION OF BREAKWATER AT BURLINGTON, VERMONT.

[Printed in Senate Doc. No. 105, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, January 23, 1901.

SIR: I have the honor to return herewith concurrent resolution of Congress, as follows:

Resolved by the Senate (the House of Representatives concurring), That the Secretary of War be, and he is hereby, directed to furnish Congress with a report showing the present condition of the breakwater at Burlington, Vermont, with an estimate of cost for its proper repair and completion—

and in compliance with the terms of said resolution to submit the accompanying copy of report dated December 20, 1900, by Col. J. W. Barlow, Corps of Engineers.

Very respectfully, your obedient servant,

A. MACKENZIE,
Acting Chief of Engineers.

Hon. ELIHU ROOT,
Secretary of War.

CONDITION OF BREAKWATER, BURLINGTON HARBOR, VERMONT.

UNITED STATES ENGINEER OFFICE,
New York City, December 20, 1900.

GENERAL: I have the honor to submit the following special report upon the condition of the breakwater at Burlington, Vt.

This breakwater is built in Lake Champlain in front of the city and forms a harbor for the protection of the wharves and shipping at this point.

The length of the main structure is 3,803 feet, and there is also a detached section 350 feet long, placed 200 feet north of the main section.

The substructure of the entire work is of timber cribs filled with stone and was built at different periods from 1836 to 1890, the last work being the detached section. Its trace is very irregular, the object apparently being to follow a line approximately parallel to the shore. The width of the breakwater varies from 24 to 36 feet, its height being 8 feet above low water, and the depth of water is about 30 feet.

The character of the work also varies with the date of construction, the older parts being largely of round timber fastened with wooden pins, while during more recent periods squared timber iron bolted was used.

Originally the superstructure was of timber and stone, the cross section varying from the full width of the cribs to a narrow parapet on the lake side 10 or 12 feet wide.

In recent years some portions of the decayed timber superstructure have been replaced by a stone parapet 24 feet wide at base with sloping sides. The interior portion of this parapet was composed of rip-

rap and the sides and top surface formed of large stone. On the lake side these slabs of stone rest against the upper timbers of the outer wall, producing more or less thrust, which in some cases proved to be greater than the wall could resist. Doubtless vibrations in the structure during heavy storms added materially to the strain. The result has been that the outer wall has given way in places, allowing the large stones to slip into the lake and exposing the core of riprap to destruction. So serious had this damage become in one of the sections that emergency repairs were made during the present season, but owing to the advent of very severe weather the work was only partially completed.

During the past season a section of concrete superstructure has been built to replace a part of the decayed and crumbling timber work. It is a monolithic arch having a rubble core, and rests upon concrete footing blocks, which were placed upon a carefully prepared foundation below the water surface. The width at bottom is 16 feet, and the top is 8 feet above low water.

The outer line of footing blocks is nearly flush with the lake wall of the substructure; but on the inner side a considerable berm was left, which was intended to be covered with planking below the surface of the water.

Several storms of rather more than usual violence have occurred during the late autumn, which have seriously tested the entire superstructure and have caused much damage at several places.

It was expected that the old and rotten timber work would suffer, but the damage to the more recent stone parapet was also serious, and, as stated above, considerable immediate repairs were made upon one of the sections to prevent greater destruction.

The concrete section had been in place but a few days when a heavy storm came up, but it sustained no injury whatever, though the plank decking back of it which was not fully fastened down was torn away, carrying with it some of the timber structure below. This result was due to the character of the old work, as it was afterwards discovered that the wooden pins and dovetails which were intended to hold the timbers in place had become so worn by the action of the waves during a period of over fifty years that there was practically no connection between the upper courses of the old timbers. How far down this defective condition extended was not ascertained, but a careful examination will be made in the spring to discover this fact.

I have carefully examined the entire superstructure of this break-water during the past season, and my assistant, Mr. Kelsey, was directed to make a report of its condition. I am therefore enabled to state that the entire superstructure should be rebuilt in a substantial manner within the next few years, and that about 2,100 feet thereof should be reconstructed at the earliest possible date. This is necessary to preserve the main work and protect the wharves of the harbor from damage by storms. I therefore recommend that the matter be submitted to Congress with a view to obtaining a suitable appropriation to carry on the work continuously until completed, and would further recommend that the new work be of concrete, substantially in accordance with the section now in progress.

Under the present contract the concrete superstructure is costing about \$30 per linear foot, but as it may not be possible to secure as low bids another season on account of the unforeseen expense of tear-

ing down the old work and preparing the foundation for the new superstructure, I now estimate the cost at \$35 per linear foot, which is still less than was paid for the stone parapet last constructed.

The length requiring immediate renewal is 2,100 feet, less 450 feet now under construction, leaving 1,650 feet, which, at \$35 per foot, will require \$57,750. The work should be provided for under one appropriation or else put under the continuous-contract system, so that there will be no delay in completing it; otherwise great damage may happen to the breakwater, which would require a far greater expenditure in repair work than is now proposed.

In addition to the above, provision should be made for the reconstruction of the remainder of the superstructure, 2,053 feet, which, at \$35 per foot, will cost \$71,855. The expenditure of this amount will probably be required upon the completion of the work now urgently needed.

Very respectfully, your obedient servant,

J. W. BARLOW,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

APPENDIX C.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS SOUTH OF AND INCLUDING LYNN HARBOR.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, COL. CHARLES R. SUTER AND LIEUT. COL. W. S. STANTON, CORPS OF ENGINEERS.

IMPROVEMENTS.

- | | |
|--|---|
| 1. Lynn Harbor, Massachusetts. | 8. Duxbury Harbor, Massachusetts. |
| 2. Mystic and Malden rivers, Massachusetts. | 9. Plymouth Harbor, Massachusetts. |
| 3. Mystic River, Massachusetts, below mouth of Island End River. | 10. Provincetown Harbor, Massachusetts. |
| 4. Boston Harbor, Massachusetts. | 11. Chatham Harbor, Massachusetts. |
| 5. Town River, Massachusetts. | 12. Removing sunken vessels or craft obstructing or endangering navigation. |
| 6. Weymouth River, Massachusetts. | |
| 7. Scituate Harbor, Massachusetts. | |

EXAMINATIONS AND SURVEYS.

- | | |
|---------------------------------|-----------------------------------|
| 13. Lynn Harbor, Massachusetts. | 14. Boston Harbor, Massachusetts. |
|---------------------------------|-----------------------------------|

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 20, 1901.

GENERAL: I have the honor to transmit herewith annual reports for the works of river and harbor improvements in my charge for the fiscal year ending June 30, 1901.

* * * * *

Very respectfully, your obedient servant,

W. S. STANTON,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

C 1.

IMPROVEMENT OF HARBOR AT LYNN, MASSACHUSETTS.

The existing project having been completed with the exception of the building of the training wall, the necessity for which is not yet

apparent (annual report for 1900, p. 1190), no work has been done upon the improvement during the fiscal year.

Lynn is a port of entry in the collection district of Marblehead, Mass. The nearest light-house is Egg Rock (Nahant) light, 3 miles distant.

Money statement.

July 1, 1900, balance unexpended.....	\$7,024.36
June 30, 1901, amount expended during fiscal year.....	149.10
July 1, 1901, balance unexpended.....	6,875.26
Amount (estimated) required for completion of existing project	53,500.00

The dates and amounts of appropriations for this work are as follows:

Act of—	Act of—
August 2, 1882..... \$60,000	August 18, 1894..... \$7,500
August 5, 1886..... 6,000	June 3, 1896..... 20,000
August 11, 1888..... 10,000	
September 19, 1890..... 15,000	Total..... 128,500
July 13, 1892..... 10,000	

The accompanying commercial statistics were furnished by the collector of customs at Marblehead, Mass.

COMMERCIAL STATISTICS.

Amount of revenue collected:

1899.....	\$299.31
1900.....	1,284.66
1901.....	2,301.69

Shipping.

	1899.		1900.		1901.	
	Num-ber.	Tons.	Num-ber.	Tons.	Num-ber.	Tons.
Entrances:						
Foreign.....	7	661	9	848	15	1,425
Domestic.....	916	180,000	2,198	688,297	2,234	700,242
Clearances:						
Foreign.....	7	661	28	6,356	15	1,425
Domestic.....	916	180,000	2,198	688,297	2,234	700,242

Imports.

Articles.	1899.	1900.	1901.
Coal.....tons..	141,523	197,028	212,205
Iron.....do.....		2,019	1,271
Lumber.....feet..	290,000	131,303	1,415,543
Miscellaneous a.....tons..	60,006	110,000	123,930

a Lime, cement, sand, bricks, stone, hay, etc.

During 1901, 150,000 tons miscellaneous cargoes were exported.

All classes of vessels frequent the harbor, to a maximum draft of 18 feet. Maximum tonnage, 1,650.

C 2.

IMPROVEMENT OF MYSTIC AND MALDEN RIVERS, MASSACHUSETTS.

In the Malden River the channel, which had been dredged up to the first bridge to the full depth and width authorized by the existing project, was redredged October 15, 1900, to December 17, 1900, when 13,576 cubic yards of mud were removed under a contract with Augustus B. Martin, of Boston, completing the contract and restoring the authorized depth with a least width of 50 feet, at a cost of \$6,516.20.

For this redredging, in addition to the balance of \$1,500 that was available of the appropriation by act of March 3, 1899, the Secretary of War, July 19, 1900, allotted \$5,000 from the emergency river and harbor act of June 6, 1900.

To restore the channel that had been obtained under the existing project, there remain to be dredged 12,000 cubic yards at an estimated cost of \$5,280.

DETERIORATION.

Comprising the redredging in 1899, at a cost of \$938.72, and the redredging done in 1900 and remaining to be done June 30, 1901, the deterioration amounts to \$12,734.92.

The bed is of soft mud, the banks are marshy, and the caving of the banks and the silt from the flats will entail frequent redredging for maintenance.

Nothing has been done upon the improvement of the Mystic River during the year.

To complete the existing project there remain to be obtained the entire authorized depth and width—in the Mystic for a distance of 6,440 feet up to Medford, and in the Malden for a distance of 1,280 feet from the first bridge up to the second bridge.

The improvement already made in the Mystic above Dennings wharf in Somerville is not available to commerce because the improved channel does not extend to the next wharf at Medford.

Mystic and Malden rivers are in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

Money statement.

July 1, 1900, balance unexpended	\$4,033.06
Amount appropriated by act of June 6, 1900.....	5,000.00
	9,033.06
June 30, 1901, amount expended during fiscal year	6,461.06
July 1, 1901, balance unexpended	2,572.00
(Amount (estimated) required for completion of existing project.....	27,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$27,000.00
For maintenance of improvement.....	5,280.00
	32,280.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of appropriations for this work are as follows:

For Malden River, by act of August 2, 1882.....	\$10,000
For Mystic and Malden rivers, by act of July 13, 1892.....	10,000
For Mystic and Malden rivers, by act of August 18, 1894.....	10,000
For Mystic and Malden rivers, by act of June 3, 1896.....	10,000
For Mystic and Malden rivers, by act of March 3, 1899.....	5,000
For Malden River, by act of June 6, 1900.....	5,000

Total	50,000
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Commercial statistics are included in the statement for Boston Harbor, Massachusetts.

C 3.

IMPROVEMENT OF MYSTIC RIVER BELOW THE MOUTH OF ISLAND END RIVER, MASSACHUSETTS.

There were dredged from the channel, under the contract of November 8, 1899, with Mr. Charles H. Souther, of Boston, Mass., 86,511 cubic yards of material, July 1, 1900, to December 19, 1900, when the contract was completed, increasing the channel to the authorized depth of 25 feet at mean low water, to the width of 100 feet below the Chelsea Bridge, and to a least width of 125 feet from that bridge to Island End River.

Under the existing project 184,264 cubic yards of material have been removed from the channel, all under the contract with Mr. Souther.

Mystic River is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Spectacle Island, Boston Harbor, Massachusetts.

Money statement.

July 1, 1900, balance unexpended.....	\$26,251.81
June 30, 1901, amount expended during fiscal year.....	23,764.93
July 1, 1901, balance unexpended.....	2,486.88
{ Amount (estimated) required for completion of existing project	217,547.50
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	217,547.50
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of appropriations for this work are as follows:

By river and harbor act of March 3, 1899.....	\$50,000
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Commercial statistics are included in the statement for Boston Harbor, Massachusetts.

C 4.

IMPROVEMENT OF HARBOR AT BOSTON, MASSACHUSETTS.

THE MAIN SHIP CHANNEL.

During the fiscal year, under the project approved by the act of July 13, 1892, to widen the channel to 1,000 feet and to deepen it to 27 feet at mean low water, there have been dredged, under the contin-

uing contract of February 11, 1897, with Breyman Brothers, of Toledo, Ohio, 554,503.5 cubic yards of mud, sand, etc., and under the contract of August 1, 1900, with Chas. W. Johnston, of Lewes, Del., 3,200 cubic yards of ledge have been removed. This dredging and rock excavation have all been in that part of the channel which extends from President Roads to Boston. The rock was removed at the "Upper Middle."

This channel, 16,600 feet in length, from President Roads to Boston, which on June 30, 1900, had been dredged to a depth of 27 feet at mean low water and least width of 500 feet, has, by the above dredging and rock excavation, July 1, 1900, to June 30, 1901, been widened to the full width of 1,000 feet with a depth of 27 feet at mean low water, excepting for a length of 3,400 feet at the "Upper Middle," where the width is still 500 feet and the depth 26 feet at mean low water upon several groups of ledges the removal of which to 27 feet is nearly completed. At the "Lower Middle" the available width of the channel, 27 feet deep, is restricted to 600 feet by a group of ledges which are on the north side, on which the least depth is 23 feet at mean low water.

In the channel from Nantasket Roads to President Roads, which to June 30, 1899, had been dredged to the depth of 27 feet at mean low water and full width of 1,000 feet, the available width between Georges and Lovells islands is still restricted to 750 feet by ledges which are principally on the Georges Island side.

The contractor transfers his plant from the main ship channel to the Broad Sound channel during the comparatively brief period annually when dredging can be done in the latter very exposed location.

BROAD SOUND.

Under the project approved by act of March 3, 1899, to make this channel 1,200 feet wide and 30 feet deep at mean low water, from President Roads to the sea, there have been dredged from it during the fiscal year under contract of March 13, 1900, with Breyman Brothers, of Toledo, Ohio, July to December, 1900, and in May and June, 1901, 206,072 cubic yards of sand, gravel, etc., and 18,037 cubic yards of bowlders, obtaining a channel 30 feet deep at mean low water and at least 250 feet wide from President Roads to the sea.

SEA WALLS.

During the fiscal year at Rainsford Island 505 linear feet of sea wall were repaired, 508 linear feet of paving reset, and the riprap protecting the foundation along 475 feet of wall was rearranged.

At Castle Island 50 linear feet of sea wall were rebuilt, excepting a part of the coping course, and 90 linear feet in addition were repaired.

DETERIORATION.

At the date of this report, of the three sea walls at the North, Middle, and South Heads on Deer Island, aggregating 3,206 linear feet, 1,887 linear feet were more or less demolished by the gales of 1898 and 1899, and are in need of immediate rebuilding.

The sea wall 2,840 feet in length on Great Brewster Island and the

sea wall 1,202.5 feet in length at Point Allerton are in immediate need of extensive repointing and of minor repairs to the filling and paving.

The sea wall on Gallops Island needs to have its foundation protected with riprap.

The estimated cost of the aforesaid repairs is as follows:

Sea wall on Deer Island:	
North Head	\$40,519.60
Middle Head	20,480.90
South Head.....	9,428.10
	70,428.60
Sea wall on Great Brewster Island.....	5,500.00
Sea wall on Point Allerton.....	1,500.00
Sea wall on Gallops Island.....	2,000.00
Total	79,428.60

The repairs to the seawall at Middle Head, Deer Island, which were commenced in May, 1901, are in progress with the allotment of \$15,000 made by the Department September 12, 1900.

TRIBUTARY CHANNELS.

By provisos in the following acts of Congress amounts as follows have been appropriated for these improvements from the sums appropriated by those acts for the improvement of Boston Harbor.

Charles River:

In act of June 14, 1880	\$22,500
In act of March 3, 1881.....	35,000
In act of September 19, 1890.....	20,000

Total	77,500
Amount not yet appropriated	47,500

Total estimated cost of existing project	125,000
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Fort Point Channel:

In act of August 5, 1886	18,750
Amount not yet appropriated	60,000

Total estimated cost of existing project	78,750
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Chelsea Creek:

In act of June 3, 1896	7,000
In act of March 3, 1899.....	5,000

Total	12,000
Amount not yet appropriated	53,000

Total estimated cost of existing project	65,000
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No work has been done on these three channels during the fiscal year.

SURVEY OF BOSTON HARBOR.

In pursuance of a requirement in the emergency river and harbor act of June 6, 1900, a survey of the harbor was made during the summer and fall of 1900, and report and project of improvement were

submitted November 26, 1900, and published in House Doc. No. 119, Fifty-sixth Congress, second session. The cost of the survey was \$17,500, which sum was allotted for the survey from the balance from appropriations for general improvement of Boston Harbor.

The several works completed and projected for the improvement of this harbor are located in the collection district of Boston and Charlestown, Mass. Boston is the port of entry.

Money statement.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1900, balance unexpended	¹ \$103,812.16
June 30, 1901, amount expended during fiscal year	24,291.03
July 1, 1901, balance unexpended	79,521.13
July 1, 1901, outstanding liabilities	1,776.95
July 1, 1901, balance available	77,744.18
Amount (estimated) required for completion of existing project	160,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$160,500.00
For maintenance of improvement	50,000.00
	210,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

PROJECT OF 1892.

July 1, 1900, balance unexpended	² \$504,542.17
June 30, 1901, amount expended during fiscal year	148,486.77
July 1, 1901, balance unexpended	356,055.40
July 1, 1901, outstanding liabilities	50,231.93
July 1, 1901, balance available	305,823.47
July 1, 1901, amount covered by uncompleted contracts	71,637.94

PROJECT FOR BROAD SOUND.

July 1, 1900, balance unexpended	\$321,786.73
Amount appropriated by sundry civil act approved March 3, 1901	133,000.00
June 30, 1901, amount expended during fiscal year	454,786.73
July 1, 1901, balance unexpended	49,161.70
July 1, 1901, balance unexpended	405,625.03
July 1, 1901, outstanding liabilities	27,570.21
July 1, 1901, balance available	378,054.82
July 1, 1901, amount covered by uncompleted contracts	220,503.50

¹ Erroneously reported in annual report for 1900 as \$98,812.16.

² Erroneously reported in annual report for 1900 as \$509,542.17.

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1825	\$52,972.56	June 10, 1872	\$75,000.00
March 19, 1828	2,000.00	March 3, 1873	150,000.00
May 23, 1828	87,000.00	June 23, 1874	100,000.00
March 2, 1829	7,310.54	March 3, 1875	100,000.00
March 2, 1831	5,000.00	August 14, 1876	50,000.00
March 2, 1831	12,390.00	June 18, 1878	55,000.00
February 24, 1832	9,000.00	March 3, 1879	50,000.00
July 3, 1832	60,000.00	June 14, 1880	75,000.00
July 4, 1836	15,000.00	March 3, 1881	100,000.00
July 7, 1838	7,353.00	August 2, 1882	96,500.00
March 3, 1841	1,000.00	July 5, 1884	5,000.00
March 3, 1841	1,500.00	August 5, 1886	56,250.00
August 31, 1842	2,000.00	August 11, 1888	125,000.00
March 3, 1843	16,000.00	September 19, 1890	145,000.00
July 20, 1848	40,000.00	July 13, 1892	300,000.00
August 30, 1852	30,000.00	August 18, 1894	200,000.00
July 2, 1864	40,000.00	June 3, 1896	70,000.00
July 2, 1864	10,000.00	June 4, 1897 ¹	400,000.00
February 28, 1865	3,000.00	July 1, 1898 ¹	250,000.00
February 28, 1865	20,000.00	March 3, 1899	75,000.00
June 12, 1866	50,000.00	March 3, 1899 ¹	163,751.00
July 12, 1866	75,000.00	June 6, 1900 ¹	317,000.00
March 2, 1867	375,000.00	March 3, 1901 ¹	133,000.00
July 11, 1870	100,000.00		
March 3, 1871	100,000.00	Total	4,213,027.10

LIST OF CONTRACTS IN FORCE JUNE 30, 1901.

Contract dated February 11, 1897: Breyman Brothers, Toledo, Ohio, contractors, to dredge 2,910,718 cubic yards, more or less, of material from the main ship channel, Boston Harbor, Massachusetts, at 17½ cents per cubic yard; approved March 9, 1897; to be commenced April 1, 1897; to be completed June 30, 1900; time of completion extended to October 30, 1902, on February 27, 1900.

Contract dated March 13, 1900: Breyman Brothers, of Toledo, Ohio, contractors, to dredge 836,082 cubic yards, more or less, of material from Broad Sound Channel, Boston Harbor, Massachusetts, at 35 cents per cubic yard; approved March 31, 1900; to be commenced July 1, 1900; to be completed June 30, 1902.

Contract dated August 1, 1900: Charles W. Johnston, Lewes, Del., contractor; to remove 3,446 cubic yards of ledge from the main ship channel, Boston Harbor, Massachusetts, at \$15.80 per cubic yard; approved August 13, 1900; to be commenced August 10, 1900; to be completed February 28, 1901; time of completion extended to July 30, 1901.

COMMERCIAL STATISTICS.

The accompanying commercial statistics for the fiscal year ending June 30, 1901, have been furnished by the collector of customs at Boston, Mass.:

Amount of revenue collected:

1899	\$15,689,276.26
1900	18,871,848.99
1901	20,123,155.62

Entrances and clearances.

	1899.		1900.		1901.	
	Num-ber.	Tons.	Num-ber.	Tons.	Num-ber.	Tons.
Entrances:						
Foreign	1,587	1,989,784	1,643	2,016,121	1,482	2,274,318
Domestic	193	140,011	217	219,473	209	223,019
Clearances:						
Foreign	1,426	1,710,822	1,504	1,660,587	1,339	2,005,985
Domestic	281	161,926	305	248,095	259	226,462

¹ Sundry civil act.

Imports and exports.

	1899.	1900.	1901.
<i>Imports.</i>			
Merchandise	\$52,101,069	\$72,161,687	\$61,456,207
Coin and bullion	114,135	134,602	57,509
<i>Exports.</i>			
Foreign:			
Merchandise	2,437,731	1,243,486	802,346
Coin and bullion	2,904	3,384	
Domestic:			
Merchandise	125,600,258	110,946,023	142,905,886
Coin and bullion	19,505	22,500	8,000

Vessels engaged in the coastwise trade are not required by law to enter and clear from the custom-house unless they have in their cargoes bonded merchandise to the value of \$350 or more. For this reason the above records of the custom-house as regards domestic commerce represent but a fractional part of the actual domestic commerce of the port.

From the Boston Chamber of Commerce has been obtained the following record of—

Domestic commerce for the calendar year of 1900.

	Number.	Aggregate gross tonnage.
Arrivals.....	10,436	8,244,860
Departures.....	10,436	8,244,860
Total.....	20,872	16,489,720

C 5.

IMPROVEMENT OF TOWN RIVER, MASSACHUSETTS.

There have been no funds for the improvement of this river during the fiscal year.

DETERIORATION.

The channel, which to November 10, 1899, had been dredged to the authorized depth of 4 feet at mean low water for a length of 4,500 feet, with a width of 50 to 100 feet, has deteriorated by deposit so that the removal of 16,700 cubic yards of material will be necessary to restore it to the authorized depth, at an estimated cost of \$5,318.61.

Town River is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

Money statement.

July 1, 1900, balance unexpended	\$276.55
June 30, 1901, amount expended during fiscal year	8.06
July 1, 1901, balance unexpended	268.49
{ Amount (estimated) required for completion of existing project	7,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$7,000.00
For maintenance of improvement	5,318.61
	12,318.61
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of appropriations for this work are as follows:

Act of—	
June 3, 1896	\$10,000
March 3, 1899	8,000
Total	18,000

Commercial statistics are included in the statement for Boston Harbor, Massachusetts.

C 6.

IMPROVEMENT OF WEYMOUTH RIVER, MASSACHUSETTS.

No work was done upon this improvement during the fiscal year ending June 30, 1901.

June 30, 1900, the channel in Weymouth (Fore) River had been dredged to the authorized depth of 6 feet at mean low water, 100 feet wide, for a length of 3,600 feet, 60 feet wide for a length of 1,500 feet, and 50 feet wide for the remaining length of the part under improvement. The upper part of the channel was somewhat obstructed by several small ledges on which the least depth was about 5 feet. In Weymouth (Back) River the channel had been dredged 12 feet deep at mean low water, 200 feet wide through the bar, and 125 feet wide thence to the wharf of the Bradley Fertilizer Company.

DETERIORATION.

The channel dredged in the Fore River has deteriorated to a depth of 5 feet, at mean low water, by deposit, the removal of which is estimated to cost \$5,576.67.

Weymouth River is in the collection district of Boston, Mass., of which Boston is the port of entry. The nearest light-house is on Long Island, Boston Harbor, Massachusetts.

Money statement.

July 1, 1900, balance unexpended	\$923.40
July 1, 1901, balance unexpended	923.40
(Amount (estimated) required for completion of existing project	12,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$12,000.00
For maintenance of improvement.....	5,576.67
	17,576.67
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of the appropriations for this work are as follows:

Act of—	
September 19, 1890.....	\$10,000
July 13, 1892.....	10,000
August 18, 1894.....	5,000
June 3, 1896.....	15,000
March 3, 1899.....	10,000
Total	50,000

Commercial statistics are included in the statement for Boston Harbor, Massachusetts.

The character of commerce benefited by the improvement of this river is the supply of coal, lumber, and general merchandise to the populous district surrounding it. The annual value of this commerce approximates \$750,000.

C 7.

IMPROVEMENT OF HARBOR AT SCITUATE, MASSACHUSETTS.

During the fiscal year ending June, 30, 1901, the amount expended has been applied wholly to maintenance in dredging from the channel near the wharves a part of a shoal of gravel that is encroaching upon it. June 22 to 30, under emergency contract with the Eastern Dredging Company, 1,583.5 cubic yards of gravel were removed.

DETERIORATION.

By encroachment of shoal of gravel.

Amount expended for redredging in June, 1901.....	\$596.32
Estimated cost of removing remainder of gravel deposit.....	1,050.46
Total.....	1,646.78

Scituate Harbor is in the collection district of Plymouth, Mass.

Money statement.

July 1, 1900, balance unexpended	\$2,137.17
June 30, 1901, amount expended during fiscal year	244.43
July 1, 1901, balance unexpended	1,892.74
July 1, 1901, outstanding liabilities	594.12
July 1, 1901, balance available	1,298.62
{ Amount (estimated) required for completion of existing project	186,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	30,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1829	\$180	September 19, 1890	\$10,000
August 30, 1852	1,000	July 13, 1892	10,000
June 14, 1880	7,500	August 18, 1894	10,000
March 3, 1881	10,000	June 3, 1896	6,000
August 2, 1882	10,000	March 3, 1899	15,000
July 5, 1884	10,000		
August 5, 1886	10,000	Total	104,680
August 11, 1888	5,000		

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

Amount of revenue collected:

1899	\$450. 00
1900	1, 224. 88
1901	286. 50

Entrances and clearances.

	1899.	1900.	1901.
Entrances:			
Foreign	2	6	3
Domestic	16		12
Clearances:			
Foreign	2	6	3
Domestic	16		12

Imports.

Articles.	1899.	1900.	1901.
Coal	3, 500	3, 500	4, 000
Lumber	2, 000, 000	1, 250, 000	3, 000, 000
Lime and cement	1, 500	1, 900	4, 000
Brick	250, 000	400, 000	600, 000

Vessels frequenting the harbor are schooners and barges; draft of water, 10 to 12 feet, the limit in depth to the wharves.

C 8.

IMPROVEMENT OF HARBOR AT DUXBURY, MASSACHUSETTS.

No work has been done on the improvement during the fiscal year for want of funds.

Duxbury Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-house is Duxbury Pier light, about 3 miles distant.

Money statement.

July 1, 1900, balance unexpended	\$96. 26
July 1, 1901, balance unexpended	96. 26
July 1, 1901, balance available	96. 26
{ Amount (estimated) required for completion of existing project	5, 820. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	5, 820. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of appropriations for this harbor are as follows:

June 10, 1872	¹ \$10, 000
March 3, 1873	¹ 10, 000
March 3, 1899	12, 000
Total	32, 000

¹ Expended in 1872-1874 in improving the Miles or South Channel.

COMMERCIAL STATISTICS.

The accompanying commercial statistics were furnished by the collector of customs at Plymouth, Mass.

Domestic shipping.

Entrances.....	7
Clearances.....	7

Imported for 1901.

Coal.....	tons..	1,309
Lumber.....	feet..	276,000

Coasting vessels of 16 feet maximum draft frequent the harbor.

C 9.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

The amount expended during the fiscal year has been applied wholly to the construction of a dike of riprap on Long Beach, under the design approved by the Secretary of War June 5, 1899, for the application of \$75,000 appropriated by the act of March 3, 1899.

July 1, 1900, to October 25, 729 linear feet of the dike, containing 3,861.75 tons of stone, were built under the contract of August 18, 1899, with Bell & Co., of Boston, Mass.

October 25, 1900, that contract was annulled because of unsatisfactory progress, and on November 20, 1900, an emergency contract was entered into with the Rockport Granite Company to insure the speedy advance of the dike along the lowest and most exposed parts of the beach, and prevent disaster that severe storms could hardly fail to cause to the beach and harbor.

By the Rockport Granite Company there have been built: November 24, 1900, to May 10, 1901, under the emergency contract, 1,823 linear feet of dike, containing 6,180 tons of stone, at \$2.13 per ton; and May 11 to June 30, 1901, under formal contract of May 16, 1901 (abstracts of bids and contracts herewith), 839.5 linear feet of dike, containing 2,215 tons of stone.

The total length of dike constructed during the fiscal year is thus 3,391.5 linear feet, containing 12,256.75 tons of stone.

The entire length of dike constructed on Long Beach to June 30, 1901, under the appropriation of March 3, 1899, and design approved by the Secretary of War June 5, 1899, is 3,941.5 linear feet, containing 14,872.25 tons of stone.

Bell & Co. built (under their contract of August 18, 1899, annulled October 25, 1900), 1,279 linear feet of the dike, containing 6,477.25 tons of stone.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier light, about 2 miles distant.

Money statement.

July 1, 1900, balance unexpended	\$71,290.18
June 30, 1901, amount expended during fiscal year	20,136.62
July 1, 1901, balance unexpended	51,153.56
July 1, 1901, outstanding liabilities	4,446.35
July 1, 1901, balance available	46,707.21
July 1, 1901, amount covered by uncompleted contracts	39,283.65
{ Amount (estimated) required for completion of existing project	20,700.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	20,700.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	\$20,000.00	March 3, 1875	\$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
July 11, 1870	10,000.00	June 3, 1896	1,500.00
March 3, 1871	10,000.00	March 3, 1899	{ 10,000.00
June 10, 1872	2,500.00		{ 75,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	267,766.90

ABSTRACT OF CONTRACT IN FORCE JUNE 30, 1901.

Contract dated May 16, 1901: Rockport Granite Company, contractors; to deposit 23,000 tons, more or less, of rubblestone in the riprap on Long Beach, at \$1.89 per ton of 2,000 pounds; approved June 12, 1901; to be commenced June 29, 1901; to be completed February 28, 1902.

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

Amount of revenue collected:

1899	\$10,678.00
1900	603.91
1901	757.95

Entrances and clearances.

	1899.	1900.	1901.
Entrances:			
Foreign	5	4	5
Domestic	61	73	58
Clearances:			
Foreign	7	6	5
Domestic	61	71	58

Imports.

	1899.	1900.	1901.
Coal.....tons..	20,001	23,649	28,928
Lumber.....feet..	3,080,000	3,015,000	2,600,000
Brick.....number..		600,000	

Barges and schooners up to 18 feet draft frequent the harbor.

C 10.

IMPROVEMENT OF HARBOR AT PROVINCETOWN, MASSACHUSETTS.

During the fiscal year 553 linear feet of plank bulkhead, with sand and gravel filling, were built for the preservation of the beach southwest of the harbor at Abel Hill.

One thousand five hundred dollars should be made available for maintenance of the works for the preservation of the beach to June 30, 1903. For building the bulkhead of riprap for the security of the most critical part of the beach southwest of the harbor, as recommended in the annual report for 1897, page 878, the further sum of \$13,200 can be advantageously expended to that date.

Provincetown, Mass., is a port of entry in the collection district of Barnstable, Mass. The nearest light-houses are Wood End and Long Point lights.

Money statement.

July 1, 1900, balance unexpended	\$11,815.54
June 30, 1901, amount expended during fiscal year	1,783.67
July 1, 1901, balance unexpended	10,031.87
(Amount (estimated) required for completion of existing project.....	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement in addition to the balance unexpended July 1, 1901	1,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of the appropriations for this work are as follows:

Act of—	Act of—
May 19, 1826.....\$3,500.00	August 14, 1876.....\$4,000.00
March 2, 1829.....3,500.00	June 18, 1878.....1,000.00
March 2, 1831.....2,050.00	March 3, 1879.....1,000.00
March 3, 1832.....4,600.00	June 14, 1880.....500.00
June 28, 1834.....4,400.00	March 3, 1881.....5,000.00
March 3, 1835.....4,400.00	August 2, 1882.....5,000.00
July 2, 1836.....4,400.00	July 5, 1884.....2,000.00
July 7, 1838.....4,500.00	August 5, 1886.....3,000.00
August 30, 1852.....5,000.00	August 11, 1888.....3,000.00
June 23, 1866.....43,068.44	September 19, 1890.....7,500.00
July 28, 1866.....8,000.00	July 13, 1892.....1,500.00
March 3, 1871.....6,000.00	August 18, 1894.....1,500.00
June 10, 1872.....5,000.00	June 3, 1896.....1,500.00
March 3, 1873.....6,000.00	March 3, 1899.....10,000.00
June 23, 1874.....6,000.00	
March 3, 1875.....5,000.00	
	Total.....165,918.44

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Barnstable, Mass.

Amount of revenue collected:

1899.....	\$285. 13
1900.....	1, 701. 95
1901.....	189. 43

Entrances and clearances.

	1899.		1900.		1901.	
	Num-ber.	Tons.	Num-ber.	Tons.	Num-ber.	Tons.
Entrances:						
Foreign.....	20	5, 000	14	7, 000	15	2, 500
Domestic.....	10	1, 000	16	800	12	900
Clearances:						
Foreign.....	10	500	9	1, 300	9	1, 650
Domestic.....	7	300	10	2, 000	5	650

Imports.

	1899.	1900.	1901.
Coal.....tons..	7, 000	7, 500	7, 000
Iron.....do.....			1, 500
Salt.....do.....	9, 000	600	500
Lumber.....feet..	1, 500, 000	1, 500, 000	1, 612, 900
Merchandise.....tons..	3, 000	5, 000	3, 000
Miscellaneous.....do.....	800	6, 000	1, 000

All classes and nationalities of vessels visit the harbor for shelter or with cargo.

The estimated value of vessels which enter the harbor (principally for shelter) during the year is \$40,000,000.

C II.

IMPROVEMENT OF HARBOR AT CHATHAM, MASSACHUSETTS.

No work has been done upon the improvement during the fiscal year under the contract entered into August 30, 1900, with R. B. Rodermond, of New York City, which has been twice extended because it is the only means of accomplishing the improvement with the authorized expenditure. (See abstract of proposals and contracts in force herewith.)

Dredging is about to be commenced at the close of the fiscal year.

DETERIORATION.

The channel, 6 feet deep at low water and 100 feet wide, that was dredged October to December, 1891, through the middle and inner bars, has deteriorated by deposit to a minimum depth at mean low water of 4 feet. Its restoration will require the dredging of 7,668 cubic yards, at an estimated cost of \$2,699.14.

Chatham Harbor is in the collection district of Barnstable, Mass., of which Barnstable is the port of entry. The nearest light-house is Hardings Beach light.

Money statement.

July 1, 1900, balance unexpended	\$8,247.89
June 30, 1901, amount expended during fiscal year	68.03
July 1, 1901, balance unexpended	8,179.86
July 1, 1901, outstanding liabilities	6.67
July 1, 1901, balance available	8,173.19
July 1, 1901, amount covered by uncompleted contracts.....	7,200.00

The dates and amounts of appropriations for this harbor are as follows:

Act of—	
September 19, 1890.....	\$5,000.00
June 3, 1896.....	5,000.00
March 3, 1899.....	3,732.79
Total.....	13,732.79

ABSTRACT OF CONTRACT IN FORCE JUNE 30, 1900.

Contract dated August 30, 1900: R. B. Rodermond, New York City, contractor; to dredge 22,500 cubic yards, more or less, of sand, etc., from the channel of Chatham Harbor, Massachusetts; contract approved September 12, 1900; to be commenced September 5, 1900; to be completed December 31, 1900; time of completion extended on December 6, 1900, to June 30, 1901; again extended on June 25, 1901, to October 8, 1901.

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Barnstable, Mass.

Imports.

	1899.	1900.	1901.
Coal.....tons..	1,600	1,200	1,200
Lumber.....feet..	300,000	337,000	375,000
Merchandise.....tons..	300	3,000	4,000

C 12.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Under provisions of sections 19 and 20 of the river and harbor act of March 3, 1899, May 18, 1901, an allotment of \$50 was made from the indefinite appropriation made by that act, to investigate the location and extent of wreckage complained of as obstructing navigation in Nauset Harbor, Massachusetts.

At the date of this report the necessary information pertaining to this wreckage is being secured.

C 13.

EXAMINATION AND SURVEY OF LYNN HARBOR, MASSACHUSETTS.

[Printed in House Doc. No. 78, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 26, 1900.

SIR: I have the honor to submit herewith copies of reports, dated June 16 and November 19, 1900, with map,¹ by Col. Charles R. Suter, Corps of Engineers, upon preliminary examination and survey, respectively, of Lynn Harbor, Massachusetts, with a view of securing a channel 200 feet wide and 15 feet deep at mean low water, including the basin extending beyond the inner ship channel, and the removal of a small point on the eastern bank of the channel near to said basin, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

Lynn Harbor has been under improvement by the General Government since 1884 with a view to securing a mean low-water depth of 10 feet, the dredging having been completed in 1899.

Colonel Suter is of opinion that the further improvement proposed by the above-mentioned act is reasonable and in proportion to the commerce involved, and he submits a plan for such improvement by dredging, at an estimated cost of \$162,936.84.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF LYNN HARBOR, MASSACHUSETTS, WITH A VIEW OF SECURING A CHANNEL 200 FEET WIDE AND 15 FEET DEEP AT MEAN LOW WATER, INCLUDING THE BASIN EXTENDING BEYOND THE INNER SHIP CHANNEL, AND THE REMOVAL OF A SMALL POINT ON THE EASTERN BANK OF THE CHANNEL NEAR TO SAID BASIN.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., June 16, 1900.

GENERAL: In accordance with instructions contained in your letter of June 13, 1900, I have the honor to submit the following report upon the preliminary examination of Lynn Harbor, Massachusetts:

Lynn Harbor is situated about 9 miles northeast of Boston Harbor, Massachusetts. It is the most important harbor of the collection district of Marblehead, and the city is a large manufacturing center.

The commerce of the port consists of coal, lumber, and other domestic supplies.

The harbor has been improved by the National Government under a project dated April 10, 1884, and the main ship channel is now 200 feet wide and 10 feet deep at mean low water.

¹Not reprinted; printed in House Doc. No. 78, Fifty-sixth Congress, second session.

The general tendency toward increased size and draft of vessels engaged in coastwise commerce makes necessary a corresponding increase in depth of the harbor channels, and, in my opinion, Lynn Harbor is worthy of further improvement to meet this necessity.

But little information additional to that possessed by this office is necessary in order to prepare a plan and estimate of cost of improvement, and the cost of a survey to secure this information is estimated to be \$250.

There is a balance of \$7,405.80 available for this harbor from appropriations for its improvement, and I respectfully recommend that \$250 of this balance be allotted to cover the cost of the survey.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 23, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Lynn Harbor, Massachusetts, required by the provisions of the emergency river and harbor act of June 6, 1900.

The locality is reported by the local officer to be worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated, the expenses of the survey to be paid from the appropriation for improving the harbor.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT, *June 25, 1900.*

Approved as recommended by the Chief of Engineers.

By order of the Acting Secretary of War:

J. B. RANDOLPH,
Acting Chief Clerk.

SURVEY OF LYNN HARBOR, MASSACHUSETTS, WITH A VIEW OF SECURING A CHANNEL 200 FEET WIDE AND 15 FEET DEEP AT MEAN LOW WATER, INCLUDING THE BASIN EXTENDING BEYOND THE INNER SHIP CHANNEL, AND THE REMOVAL OF A SMALL POINT ON THE EASTERN BANK OF THE CHANNEL NEAR TO SAID BASIN.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., November 19, 1900.

GENERAL: In accordance with your instructions of June 26, 1900, I have the honor to submit the following report (accompanied with a tracing) of the survey of Lynn Harbor, Massachusetts, with a view of securing a channel 200 feet wide and 15 feet deep at mean low water,

including the basin extending beyond the inner ship channel, and the removal of a small point on the eastern bank of the channel near to said basin, as provided for by the emergency river and harbor act of June 6, 1900.

The accompanying chart of the harbor is compiled from surveys made by the United States engineers in the development of the harbor improvements heretofore made.

Ample data for developing the proposed channel and estimating the cost thereof was on file in this office, and no new field work was necessary in preparation of the project.

At present the main ship channel of the harbor is 200 feet wide and 10 feet deep at mean low water, and at the inner end of the inner channel there is an anchorage basin 300 feet by 500 feet in area and 10 feet deep.

This channel and basin were dredged by the United States Government under a project adopted in 1884 and extended to include the anchorage basin in 1888. The estimated cost of the improvement was \$182,000, which included a training wall, designed to aid in keeping the outer channel open and estimated to cost \$65,487.

Appropriations aggregating \$128,500 have been made for this harbor by river and harbor acts from 1882 to 1896, of which sum about \$121,500 has been expended in dredging. The training wall has not as yet proved necessary and its construction has not been commenced.

In 1897 Col. S. M. Mansfield, Corps of Engineers, submitted a report on a survey of Lynn Harbor, ordered by the river and harbor act of June 3, 1896, with a view to securing a channel 300 feet wide and 15 feet deep at mean low water.

In transmitting his report to the Chief of Engineers, Colonel Mansfield said:

The large expenditure required to execute the improvement called for is scarcely justified by the interests of commerce involved. By reference to my last annual report it will be seen that during the last three years there has been a steady and comparatively large increase in the commerce of the port, and because of complaints of the insufficiency of depth of water and consequent grounding of vessels I am of opinion that the harbor is worthy of improvement to a certain extent, but not to the degree called for.

The great cost of the proposed improvement is due to the widening of the present 200-foot channel to 300 feet.

Lynn is a city of about 75,000 population, and has large manufacturing interests. Its commerce consists of supplies of coal, lumber, etc., for local consumption. By reference to my annual report for 1900 it will be seen that there was a marked increase in this commerce for the fiscal year 1899-1900.

The improvement proposed by the act of June 6, 1900, is, in my opinion, reasonable and in proportion to the commerce involved. It involves deepening the existing channels, with slight modification at the junction of the inner channel, and a relocation of the outer end of the outer channel to meet changed conditions due to the increase of depth.

I have caused the lines of the proposed channel to be laid down upon the accompanying chart, and the estimated cost of the improvement which I recommend is as follows:

Dredging 740,622 cubic yards of material, at 20 cents per cubic yard.....	\$148, 124. 40
Engineering expenses and contingencies, 10 per cent	14, 812. 44
Total	162, 936. 84

The plan and project were prepared by Assistant Engineer T. T. H. Harwood, and attention is respectfully invited to Mr. Harwood's accompanying report for further details.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. T. T. HUNTER HARWOOD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., November 19, 1900.

COLONEL: I have the honor to submit the following report upon the project for improvement of Lynn Harbor, Massachusetts, together with a plan¹ of the harbor, prepared under your instructions and in accordance with act of Congress approved June 6, 1900, "with a view of securing a channel 200 feet wide and 15 feet deep at mean low water, including the basin extending beyond the inner ship channel, and the removal of a small point on the eastern bank of the channel near to said basin."

Lynn Harbor is situated about 9 miles northeast of Boston.

The harbor has been improved by the United States Government under a project of original date of 1884, providing for a channel 200 feet wide and 10 feet deep at mean low water, and extended in 1888 so as to provide an anchorage basin 300 feet by 500 feet in area and 10 feet deep near the wharves of the city.

All dredging under these projects has been completed, and at the present time the channel and basin are practically of the dimensions designed.

The information obtained by the survey for the original project of improvement, and later surveys of sections of the channels secured during the execution of that project, provide sufficient data from which to prepare the project ordered by the act of June 6, 1900, and no additional field work was necessary.

I visited Lynn for the purpose of determining just what was intended by the clause of the act providing for "the removal of a small point on the eastern bank of the channel near to said basin."

It developed in conversation with those interested in the improvement that trouble is experienced in entering and leaving the anchorage basin.

The basin is 300 feet and the channel 200 feet wide, and at the junction of the channel with the basin a too abrupt reduction from the greater to the lesser width forms awkward points, which cause trouble to pilots navigating the channel. This trouble can be remedied by a more gradual increase from the width of the channel to that of the basin, and this improvement will result in the removal of the point referred to in the act.

The main ship channel of Lynn Harbor is divided into an outer and inner channel by a deep hole lying about west of Little Nahant and affording an anchorage of limited area under shelter of the Nahant shore.

The outer main ship channel from this anchorage to the sea was dredged in a straight line under the project of 1884. The line of this channel prolonged strikes inside or west of the 15-foot contour of the outer roadstead of the harbor, for which reason it is necessary to introduce a curve at the outer end of the outer channel, in order to reach the 15-foot depth of the roadstead and secure a sailing course about normal to the contours of the roadstead at the entrance to the channel.

This change of direction of the outer channel and the modification previously suggested at the junction of the inner channel with the basin are the only variations from the lines of the existing channel in the proposed location of the 15-foot depth of channel as laid down on the accompanying plan.

The work proposed, therefore, consists practically of an increase of 5 feet in the depth of the channel and basin already dredged to a depth of 10 feet under the project of 1884 and its extension of 1888.

¹Not reprinted; printed in House Doc. No. 78, Fifty-sixth Congress, second session.

The estimated cost of this work is as follows:

To dredge from the outer channel 206,689 cubic yards (scow measurement) of mud, sand, etc.; inner channel, 533,933 cubic yards (scow measurement) of mud, sand, etc.; total, 740,622 cubic yards, at 20 cents per yard, equals \$148,124.40; engineering expenses and contingencies, 10 per cent, \$14,812.44; total, \$162,936.84.

Very respectfully, your obedient servant,

T. T. HUNTER HARWOOD,
Assistant Engineer.

Col. CHAS. R. SUTER,
Corps of Engineers, U. S. A.

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EXAMINATION AND SURVEY OF BOSTON HARBOR, MASSACHUSETTS.

[Printed in House Doc. No. 119, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY, *Washington, December 4, 1900.*

SIR: I have the honor to submit herewith copies of reports, dated June 16, 1900, and November 28, 1900, by Col. Chas. R. Suter, Corps of Engineers, upon preliminary examination and survey, respectively, of Boston Harbor, Massachusetts, authorized by the emergency river and harbor act approved June 6, 1900, as follows:

Boston Harbor: With a view to providing channels two thousand feet wide, or such width as may be necessary, and thirty-five feet deep from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads, and from President Roads through Broad Sound channel to the ocean.

Boston Harbor is one of the most important commercial ports of the country, and the improvement contemplated in the item of the act just quoted would give it the channel facilities of a harbor of the first class. Completion of a project now in course of execution will give an available depth of but 27 feet at mean low water to the city wharves, and in the opinion of the local engineer officer the harbor is worthy of further improvement. The value of the imports and exports at Boston for the year ending June 30, 1900, approximated \$184,500,000, and the amount of revenue collected in that year was \$18,871,848.99.

In the accompanying reports estimates are given for channels in different locations and of various widths, but in concluding his survey report of November 28, 1900, Colonel Suter says:

The project which to my mind most nearly meets the ideas of Congress as expressed in the act would cover a channel to Broad Sound by the route No. 3, this channel being 35 feet deep at mean low water and 2,000 feet wide, and a channel through the upper harbor of the same depth, but only 1,500 feet in width.

The estimated cost of the entire project would be for—

Upper harbor channel	\$7, 404, 875. 50
Broad Sound channel	3, 207, 834. 96
Total	10, 612, 710. 46

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF BOSTON HARBOR, MASSACHUSETTS, WITH A VIEW TO PROVIDING CHANNELS 2,000 FEET WIDE, OR SUCH WIDTH AS MAY BE NECESSARY, AND 35 FEET DEEP FROM THE NAVY-YARD AT CHARLESTOWN AND THE CHELSEA BRIDGE AND CHARLES RIVER BRIDGE TO PRESIDENT ROADS, AND FROM PRESIDENT ROADS THROUGH BROAD SOUND CHANNEL TO THE OCEAN.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., June 16, 1900.

GENERAL: In accordance with instructions contained in your letter of June 13, 1900, I have the honor to submit the following report upon the preliminary examination of Boston Harbor, Massachusetts:

Boston Harbor is the most important harbor on the New England coast and one of the principal ports of the United States. The value of its imports and exports for the year ending June 30, 1899, approximated \$180,300,000, and the amount of revenue collected in that year was \$15,689,276.26.

Under the river and harbor acts of 1892, 1894, and 1896 provision has been made by Congress for improving the main ship channel from Boston light to the city wharves, so that it shall have a width of 1,000 feet and a minimum depth of 27 feet at mean low water; and the river and harbor act of March 3, 1899, provided for the improvement of Broad Sound channel to secure a width of 1,200 feet and minimum depth of 30 feet at mean low water from the sea to the anchorage in President Roads.

When these improvements are completed the greatest depth in the channel from the sea to the city wharves will be but 27 feet at mean low water, and 36.3 feet at mean high water.

The vessels engaged in the commerce of the port are steadily increasing in size and draft of water, and even when the authorized improvements are completed commerce will be handicapped by the necessity of waiting on high water for safe navigation of the harbor channels.

The harbor is, in my opinion, worthy of further improvement, and I respectfully recommend that a survey be made on which to base a project in accordance with the act of June 6, 1900.

The estimated cost of this survey is \$10,000. There is available from appropriations for the general improvement of the harbor a balance of about \$68,000, and I recommend that \$10,000 of this balance be allotted for expenses of the survey, in accordance with the third paragraph of the act of June 6, 1900.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 23, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Boston Harbor, Massachusetts, required by the provisions of the emergency river and harbor act of June 6, 1900.

The locality is reported by the local officer to be worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated, the expenses of the survey to be paid from the appropriation for improving the harbor.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,
June 25, 1900.

Approved as recommended by the Chief of Engineers.

By order of the Acting Secretary of War:

J. B. RANDOLPH,
Acting Chief Clerk.

SURVEY OF BOSTON HARBOR, MASSACHUSETTS, WITH A VIEW TO PROVIDING CHANNELS 35 FEET DEEP.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., November 28, 1900.

GENERAL: The emergency river and harbor act of June 6, 1900, provided for a survey of "Boston Harbor [Massachusetts], with a view to providing channels 2,000 feet wide, or such width as may be necessary, and 35 feet deep from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads, and from President Roads through Broad Sound channel to the ocean," and by your instructions of June 26, 1900, this work was assigned to me.

As soon as practicable after receipt of these instructions the necessary surveys were set on foot and have been prosecuted with all possible dispatch till finally completed on the 26th of the present month. The great magnitude of the proposed improvement called for an exhaustive study of the subject, and every effort has been made to collect all possible information needed for the purpose. The most difficult and expensive part of the work has been the search for underlying ledges, which occur irregularly all over the harbor and which add greatly to the cost of any projected improvement. To avoid these obstructions where possible, or to estimate their volume when their removal is seen to be necessary, has required a large number of borings, the execution of which, from small floats and often in very rough water, has been a tedious and difficult operation; but the information thus gained has, I think, fully justified the time and expense incurred.

The main features developed by the survey are embodied in the map which accompanies this report; and full details of the work accomplished, methods employed, etc., will be found in the accompanying report of my assistant, Mr. T. T. H. Harwood, who had immediate charge of the work.

The general features of Boston Harbor are sufficiently shown on this map to need no further elaborate description. Suffice it to say

that the work of improvement naturally divides itself into two portions, viz, that in the upper harbor from the deep water of President Roads westward to the city wharves, and that from President Roads outward to the ocean.

Systematic work for improvement of the harbor began after the close of the civil war, the first definite project, that of 1867, providing for a channel depth of 23 feet at mean low water, with varying widths at various points in the harbor. At that time the minimum depth was about 16 feet. Work under this project, including both dredging and rock removal, was prosecuted spasmodically for many years, and the full depth contemplated had been obtained, although the width was still deficient, when the project of 1892 was adopted. This provided for a channel 1,000 feet wide and 27 feet deep at mean low water, from the city to the sea through the "Narrows."

This project is still incomplete. The dredging to full width is finished from the seaward end of the channel to Castle Island; thence to the city only 500 feet in width has been cleared. In this narrow section ledges exist which reduce the available depth to 23 feet. They are in process of removal and toward the close of the winter it is hoped that the full depth of 27 feet can be carried up to the city wharves. There are still other ledges in the "Narrows" and at the "Lower Middle" which will have to be removed to get the full 1,000 feet width called for.

In 1897 a still further increase in both width and depth was deemed advisable, and on November 19 of that year Colonel Mansfield, of the Corps of Engineers, then in charge at this place, submitted a plan and estimate for the improvement contemplated. The most salient features of this plan lay in the proposed abandonment of the "Narrows channel" and the opening of a new one to the northward of Lovells Island, leading directly from President Roads to Broad Sound.

Under this project the ship channel throughout its length was to be 30 feet deep and 1,200 feet wide, and the estimated cost was \$2,126,495, of which \$481,941 was for the Broad Sound channel.

By a proviso in the river and harbor act of March 3, 1899, so much of this project as concerns the Broad Sound channel alone was adopted, and contracts for its execution were authorized. The dredging involved has been contracted for and is now in process of execution.

The project now under consideration calls for a depth of 35 feet throughout the whole length of channel from the Chelsea and Charles River bridges through Broad Sound channel to the sea, the channel to be 2,000 feet wide, or of such width as may be necessary.

Of that portion of this project which includes the upper harbor it may be said that no great variation in location is possible. The line selected avoids as much as possible the rock ledges known to exist and utilizes all work already executed or provided for. Beyond this it is merely a matter of dollars and cents to obtain any width deemed essential. The estimates herewith submitted are for widths of 2,000 and 1,500 feet, the difference in cost amounting to about \$4,000,000.

It would seem that for the upper harbor the additional accommodation afforded by a channel 2,000 feet wide over one 1,500 feet in width would not justify so large an additional expense.

When the Broad Sound channel was recommended in the project of 1897, a route was selected which involved the minimum expense. It

followed generally an existing channel of considerable depth, but deficient in width. By removing the points of several shoals and projecting ledges, the required width and depth was obtainable at a moderate cost, though the bend in the channel remained as an objection. Still, in starting this new project it was deemed advisable to consider this channel with a view to its possible enlargement. The detailed examination showed, however, that the increased width desired would involve so much rock removal that the cost became prohibitory. A second route essentially in the same location, but avoiding the bend in the channel, was rejected for the same reason, and finally the choice narrowed down to a route marked No. 3 on the map, which lies farther to the westward and apparently avoids all large ledges. It involves heavy dredging, but the estimated cost is about \$5,500,000 less than by the other routes. The only rock work known to be required is the cutting down of a ledge lying nearly a mile seaward of the channel proper, the existence of which was developed by our survey.

It therefore seems quite certain that any further increase in channel dimensions is only attainable by this route, and as it has many features besides relative cheapness in its favor its adoption is recommended.

As regards the dimensions of the new channel the depth of 35 feet at mean low water is fixed by the act under which the survey was made. In view of the rapidly increasing foreign commerce of the port and the very notable tendency to increase the size and draft of sea-going vessels this depth is not deemed excessive, and its attainment by one operation is very desirable in the interest of economy.

As regards width of channel the act fixes 2,000 feet as a maximum. This is a great advance over anything heretofore contemplated, and it was presumably based on the channel recently authorized for New York. There is no doubt whatever that this width would be of great advantage from every point of view, but more especially for the channel leading out to Broad Sound. For the channel in the upper harbor such great width is much less necessary, and in my opinion the limit of justifiable expenditure would be reached with a width of 1,500 feet. This, however, is mainly a question of expense, and the estimates herewith presented cover both a 1,500-foot and a 2,000-foot channel. The estimates are as follows:

Estimate for channel 2,000 feet wide in Upper Channel.

Dredging 29,430,865 cubic yards of sand, gravel, etc., at 20 cents per cubic yard	\$5,886,173.00
Removal of ledge—	

	Cubic yards.
At A.....	128, 805
At B.....	4, 000
At C.....	103, 876
At D.....	518
At E.....	38, 530
At F.....	18, 271

Total	294,000, at \$15 per cubic yard.....	4,410,000.00
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	10,296,173.00
Engineering expenses and contingencies, 10 per cent.....	1,029,617.30

Total	11,325,790.30
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Estimate for channel 1,500 feet wide in Upper Channel.

Dredging 21,799,675 cubic yards of sand, gravel, etc., at 20 cents per cubic yard	\$4, 359, 935. 00
Removal of ledge—	
Cubic yards.	
At A.....	31, 200
At B.....	4, 000
At C.....	89, 147
At D.....	518
At E.....	14, 982
At F.....	18, 271
Total	158, 118, at \$15 per cubic yard.....
	2, 371, 770. 00
	6, 731, 705. 00
Engineering expenses and contingencies, 10 per cent.....	673, 170. 50
Total	7, 404, 875. 50

Estimate of cost of channel 35 feet deep and 2,000 feet wide, location No. 3, Broad Sound.

Dredging 6,780,534 cubic yards of sand, gravel, clay, and hardpan, at 40 cents per cubic yard	\$2, 712, 213. 60
Excavating 5,100 cubic yards of rock, at \$40 per cubic yard.....	204, 000. 00
	2, 916, 213. 60
Engineering expenses and contingencies, 10 per cent.....	291, 621. 36
Total	3, 207, 834. 96

Estimate of cost of channel 35 feet deep and 2,000 feet wide, location No. 1, Broad Sound.

Dredging 5,737,199 cubic yards of sand, gravel, clay, and hardpan, at 40 cents per cubic yard	\$2, 294, 879. 60
Excavating 189,200 cubic yards of ledge, at \$30 per cubic yard.....	5, 676, 000. 00
	7, 970, 879. 60
Engineering expenses and contingencies, 10 per cent.....	797, 087. 96
Total	8, 767, 967. 56

The project which, to my mind, most nearly meets the ideas of Congress as expressed in the act would cover a channel to Broad Sound by the route No. 3, this channel being 35 feet deep at mean low water and 2,000 feet wide, and a channel through the upper harbor of the same depth, but only 1,500 feet in width.

The estimated cost of the entire project would be for—

Upper harbor channel.....	\$7, 404, 875. 50
Broad Sound channel.....	3, 207, 834. 96
Total	10, 612, 710. 46

Full details concerning these estimates and the information on which they are based will be found in the accompanying report of my assistant, Mr. Harwood, which meets with my entire approval and to which attention is respectfully invited.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. T. T. HUNTER HARWOOD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., November 26, 1900.

COLONEL: I have the honor to submit the following report upon a survey of Boston Harbor, Massachusetts, made, in accordance with your instructions, to secure data upon which to base a project for and estimate of cost of securing "channels 2,000 feet wide, or such width as may be necessary, and 35 feet deep from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads, and from President Roads through Broad Sound channel to the ocean," as ordered by act of Congress dated June 6, 1900.

I also submit with this report a plan of the harbor drawn to a scale of 1 : 10,000.

SURVEYS.

Previous to the present survey the information possessed by this office of the areas included in the proposed improvement consisted, in the upper harbor, of surveys dating back of 1888, and in Broad Sound of a survey made by this office in 1897.

The surveys of the upper harbor were made during the progress of improvement of the channels under the project of 1867 for dredging a channel 23 feet deep.

These surveys were utilized in 1892 in preparation of the project of that year for a channel 27 feet deep, and in 1897 in preparation of a project for a channel 30 feet deep. They were, however, inadequate in extent for preparation of a project for a channel 2,000 feet wide and 35 feet deep. For this reason, and also because of the many changes which have occurred in the harbor and channel during the last twelve or fifteen years, it was deemed necessary to make a new hydrographic survey of the channel from President Roads up to the navy-yard and bridges mentioned in the act.

The survey of Broad Sound of 1897 was made especially with a view to preparation of a project of improvement submitted to Congress in that year, and supplied ample data for the present work, except that it was necessary to extend the sounding farther seaward to provide for the proposed increase in depth.

No information as to the nature of the material underlying the bottom of the channels was possessed by this office other than that secured during the progress of the works of improvement under former projects, and none of this extended to the proposed depth.

Many ledges have been encountered in prosecution of former improvements in the various channels of the harbor, and it was of the utmost importance that as full knowledge as practicable be obtained of the location and extent of ledge formation above grade 35 feet below mean low water in the localities to be improved, and also of the nature of other material which would have to be removed. This information could only be obtained by making borings of the bottom in the several locations and at as frequent intervals as was practicable.

The work therefore to be done in the survey was:

To make a hydrographic survey of the upper harbor channels west of President Roads;

To extend into deeper water the hydrographic survey of 1897 in Broad Sound, and

To make borings over probable areas to be improved in both the upper harbor and Broad Sound.

HYDROGRAPHIC SURVEY.

The section of channel in the upper harbor to be surveyed was about 7 miles in length, and about 3.5 square miles in area. Soundings were taken on ranges run across the channel in direction approximately normal to its axis, and about 250 feet apart, and were located by two sextant observers in the sounding boat.

Over the above area a total of 49,450 soundings were taken on 170 ranges.

As a result of this work, plotted on the field sheet on a scale of 1:5,000, the office possesses a working plan of great value, showing the present condition of the channels and the changes brought about by works of improvement done in recent years by the United States Government and by the Commonwealth of Massachusetts.

In Broad Sound 10,240 soundings were taken in extension of the survey of 1897, and by them a definition of the 35-foot contour around the outer shoals of Broad Sound was secured.

BORINGS.

The boring apparatus used for the work was of the water-jet class, consisting of an outer case pipe inclosing the jet pipe, the core formed within the case pipe by driving being washed up over the top of the case pipe by the water jet.

In practice this pipe was driven to the depth of at least 35 feet at low water. If rock was encountered before this grade was reached, the apparatus was shifted slightly and another trial made to determine if ledge or a bowlder had been encountered.

Ledge located in this manner was then developed by borings more closely spaced to approximately determine its extent.

Before boring operations were commenced, preliminary study was made of the most favorable locations for the proposed channels. Over these predetermined locations borings were taken at intervals of 500 feet in general examination of the locations.

Four sets of apparatus were used on the work, operated from floats which were constructed of barrels framed into platforms. These floats were in charge of a tug, which towed them to and from the location of their work and tended them during the day.

Eight hundred and fifty-two borings were secured during the survey, aggregating 10,090.5 feet in depth. Of these, 685 were taken in the upper harbor, and 167 in Broad Sound.

The field work of the survey extended over a period of about four and one-half months.

The surveying operations in the field were under the direct charge of Messrs. Thomas J. Finn and George E. Stratton, United States hydrographers, Mr. Finn directing the operations of the boring parties and Mr. Stratton of the sounding party, and I desire to state that much credit is due to both Mr. Finn and Mr. Stratton for arduous work performed by them and their parties in the effort to secure, in the short time allowed for the necessary work, the information required for preparation of the project of improvement.

RESULTS OF THE SURVEY—UPPER HARBOR.

When the improvement of the upper main ship channel was undertaken by the United States Government under a project commonly known as the project of 1867, for the purpose of securing a channel 23 feet deep at mean low water, the principal points of improvement were on three distinct shoals known as the "Lower Middle," "Upper Middle," and "Anchorage Shoal." The "Lower Middle" is an extensive middle ground lying north of Castle Island and the main ship channel. The "Upper Middle" extended from the shoal ground at the west end of Governors Island southerly across the channel to the shoals west of Castle Island. "Anchorage Shoal" lay south of the western end of Bird Island Flats, and extended southerly toward the flats off South Boston, near Fort Point Channel.

Between these shoals there was comparatively deep water in several basins of limited area, and the deep-water anchorage of the upper harbor lay in the gorge between Boston and East Boston.

The route of the channel, as laid out under the project of 1867, has proved the most economical in all subsequent projects, and has been adopted in the present case. The increased width of the channel in the present project, however, admits of adjustment of the limits for economy of location while embracing the former location and securing the benefits of former work. The limit lines laid down upon the accompanying plan are the result of study with this point in view.

DESCRIPTION OF THE UPPER CHANNEL AS LAID DOWN ON THE PLAN.

Examination of the channel lines as laid down on the plan will show that the upper channel at its point of departure and on its first course from President Roads is in prolongation of the natural course of vessels entering the Roads from Broad Sound, and that its southern limit is approximately tangent to the 35-foot contour of President Roads. This location is most desirable, as it makes the northern part of President Roads available for anchorage ground, and, if the anchorage be governed by proper regulations, obviates any necessity for vessels, in entering or leaving the harbor, to thread their way through a fleet of vessels lying at anchor. It is further advantageous in that it is the most economical location and reduces to a minimum the angle of change in course at the next turn above.

The channel passes south of the extensive shoal ground lying to the eastward of the "Lower Middle," on curves involving minimum changes of course compatible with economy of lay out, until it reaches the narrow passage between Castle Island and the western end of the "Lower Middle."

Study of the borings show extensive ledges existing under the western end of the "Lower Middle." Outcroppings of this ledge formation are known in the harbor as

"State Ledge." Extending spurs of this ledge formation were removed to a depth of 23 feet under the name of "Cunard Ledges" in progress of work under the project of 1867, and additional ledge was uncovered by dredging to a depth of 27 feet under the project of 1892.

On the southern or Castle Island side of the channel opposite the "Lower Middle" the material was found to be sand, gravel, and clay, all easily dredgable and with but one small ledge within the probable limits of the channel. As the ledge formation under the "Lower Middle" increases in extent the farther north our investigations went, it is obvious that the limits of the channel should be thrown as far south as practicable, and this has been done.

Westward of this point there is little if any choice of location; but the limits as laid down on the plan include the areas over which work has been done under former projects, and are fixed by study with a view to economy.

Between Boston and East Boston the waterway is contracted, with a least width of about 1,450 feet. This point is a short distance below the confluence of Mystic and Charles rivers, and above this point the Mystic River has an average width of about 1,300 feet between wharves up to Chelsea Bridge, and the Charles River rapidly narrows to a width of about 600 feet near the Charles River Bridge.

In laying down the lines of the proposed channel in these contracted sections, the United States pierhead lines have been adopted as limits; but in this connection I would say that in some cases wharves project beyond the pierhead lines, and it would be impracticable to dredge invariably to those lines. Again, most of the wharves extend to the pierhead lines, and undoubtedly, with many of them, the foundations were built without provision for the present proposed increase in depth of water. On the other hand, the foundations of many of the wharves may be founded deep enough to permit of dredging to 35 feet along their fronts.

For these reasons it is desirable, in case the proposed work is authorized, that it be left to the judgment of the engineer officer in charge of execution of the work how near to the wharves the dredging shall be carried, with the United States pierhead lines as the maximum limit.

LEDGES IN THE UPPER HARBOR.

Ledges were known to exist at the "Lower Middle" and at the "Upper Middle," and in these localities borings were taken at comparatively close intervals to develop the extent of these ledges. Their locations are indicated on the plans by letters "A" and "C," respectively.

In the general examination, ledge was discovered and developed by close boring at other points, as follows:

On south side of channel near Castle Island. (Location indicated on plan by letter B.)

In the middle of the channel south of Bird Island Flats. (Location indicated on plan by letter D.)

On north side of channel at Anchorage Shoal, near west end of Bird Island Flats. (Location indicated on plan by letter E.)

On south side of channel near the new State dock in South Boston. (Location indicated on plan by letter F.)

The quantities of ledge which it will be necessary to excavate at each of these places is given in the estimates to follow.

In this connection I would state that it was impracticable, regarding both time and expense, to cover by boring all the area included in the proposed improvement closely enough to enable me to state that the ledges above reported are all that will be encountered in execution of the proposed work. While the boring was sufficiently close to insure the detection of the presence of any large masses of ledge within the limits of the proposed channel, the fact that several small ledges were discovered by single borings makes it evident that the presence of other similar ledges may have escaped detection, only to be found when the work has been undertaken, but the excessive cost of an investigation sufficiently exhaustive to fully insure against such a contingency would be utterly disproportionate to the advantage to be gained.

As a result of the boring operations, much information has been secured of the nature of the material which will have to be removed should the improvement be undertaken. It seems unnecessary to enter into a discussion of the subject in this report further than to say that the material consists of sand, gravel, clay, and "hardpan," in about the same proportions and of the same character as has been encountered in former dredging operations.

The information is set forth in full on the plans in the office records, and will be of great value for later reference when the work of excavation shall be undertaken.

ESTIMATES.

In accordance with your instructions, I submit estimates for channels 35 feet deep at mean low water, 2,000 feet wide, and 1,500 feet wide. In these estimates excavation remaining to be done in the improvement of the upper channel under the project of 1892 has been deducted from the estimate of quantities.

Estimate for channel 2,000 feet wide.

Dredging 29,430,865 cubic yards of sand, gravel, etc., at 20 cents per cubic yard	\$5,886,173 00
Removal of ledge—	Cubic yards.
At A.....	128,805
At B.....	4,000
At C.....	103,876
At D.....	518
At E.....	38,530
At F.....	18,271
Total	294,000, at \$15 per cubic yard 4,410,000. 00
	10,296,173. 00
Engineering expenses and contingencies, 10 per cent.....	1,029,617. 30
Total	11,325,790. 30

Estimate for channel 1,500 feet wide.

Dredging 21,799,675 cubic yards of sand, gravel, etc., at 20 cents per cubic yard	\$4,359,935. 00
Removal of ledge—	Cubic yards.
At A.....	31,200
At B.....	4,000
At C.....	89,147
At D.....	518
At E.....	14,982
At F.....	18,271
Total	158,118, at \$15 per cubic yard 2,371,770. 00
	6,731,705. 00
Engineering expenses and contingencies, 10 per cent.....	673,170. 50
Total	7,404,875. 50

BROAD SOUND CHANNEL.

Preliminary study of the map of the shoals lying between President Roads and Broad Sound, and through which it will be necessary to cut the channel proposed, developed three possible routes for the channel, viz:

Location No. 1.—To follow the lines of the channel 1,200 feet wide and 30 feet deep authorized by the river and harbor act of March 3, 1899, extending its width and depth to meet the present requirements.

Location No. 2.—A straight channel 2,000 feet wide on a line from the entrance to President Roads, between Long Island Head light and Deer Island light, and entering Broad Sound west of Commissioners Ledge.

Location No. 3.—A straight channel 2,000 feet wide from President Roads, east of Deer Island light and running more northerly than Location No. 2, through the shoals immediately east of Faun Bar.

The lines of these locations are laid down on the accompanying plan.

Preliminary estimates of material which would have to be removed on each of these routes gave for—

	Cubic yards.
Location No. 1	5,926,399
Location No. 2	9,173,406
Location No. 3	6,780,531

These estimates show that in regard to total excavation the advantage lay first with Location No. 1; second, with Location No. 3, and that Location No. 2 so far exceeded either of the others that it could be thrown out of consideration if the others proved practicable on closer investigation.

On Location No. 1 it was known from information obtained in the survey of 1897 that ledge would be encountered, and investigation of Location No. 3 was first taken up.

Borings were taken over the entire location and no ledge was discovered.

The material on this location was found to be sand and gravel overlying clay and "hardpan." On the shoal in extension of Faun Bar bowlders exist in large quantities, embedded in the other material.

This material will, in places, be difficult to dredge, but appears to be of the same general nature as that now being removed in the dredging operations in Broad Sound under the project for the channel 30 feet deep at low water.

The boring was made in the same manner as that in the upper harbor, and while the results show that ledge in large masses does not exist in Location No. 3, the possibility remains that small ledges may have escaped detection by the boring operations.

In prolongation seaward of the axis of this location, a ledge was discovered by the soundings taken in the hydrographic survey. This ledge is so situated that no modification of this route can avoid it, and while it does not lay in the channel proper, its removal is imperative if this location for the new channel shall be adopted.

This ledge is about three-fourths of a mile seaward of the limits of dredging and the least depth found upon it is 27.4 feet at mean low water.

It is surrounded by about 40 feet depth of water. Examination of this ledge was made by a diver, and specimens of it were secured, which show that it is slate ledge similar to that removed from different sections of the harbor under former operations.

To remove this obstruction involves the excavation of about 5,100 cubic yards of rock.

Estimate of cost of channel 35 feet deep and 2,000 feet wide, Location No. 3.

Dredging 6,780,534 cubic yards of sand, gravel, clay, and hardpan, at 40 cents per cubic yard	\$2,712,213.60
Excavating 5,100 cubic yards of rock, at \$40 per cubic yard.....	204,000.00
	2,916,213.60
Engineering expenses and contingencies, 10 per cent.....	291,621.36
Total.....	3,207,834.96

Location No. 1 is bordered on its eastern limit by ledges, known as "Commissioners Ledge," "Devils Back," and "Aldridges Ledge." These ledges are so extensive that any increase in width of channel to the eastward is impracticable, and the increase in width must be made on the western side.

The borings made in investigation of this location developed a large quantity of ledge underlying the bottom at the northwest end of the channel and extending over an area about 1,500 feet long by 450 feet wide. (The location of this ledge is indicated on the plan by letter G.)

In addition to this ledge, other points of ledge which are to be reduced to 30 feet depth of water under the authorized project for the 30-foot channel would require further excavation.

The estimated amount of ledge excavation lying within the limits of Location No. 1 is as follows:

	Cubic yards.
At the northwest end of the proposed channel	96,800
At Devils Back and Aldridges Ledge.....	27,400
Ledges under the Lovells Island Shoal.....	51,800
Ledge on western side of south end of channel	13,200
Total	189,200

From this information is prepared the following:

Estimate of cost of channel 35 feet deep and 2,000 feet wide, Location No. 1.

Dredging 5,737,199 cubic yards of sand, gravel, clay, and hardpan, at 40 cents per cubic yard	\$2, 294, 879. 60
Excavating 189,200 cubic yards of ledge, at \$30 per cubic yard	5, 676, 000. 00
	7, 970, 879. 60
Engineering expenses and contingencies, 10 per cent.....	797, 087. 96
Total	8, 767, 967. 56

In comparing this estimate with those of other locations there should be deducted \$455,000 authorized by the river and harbor act of March 3, 1899, to be expended on the channel 1,200 feet wide and 30 feet deep which lies within this location and on which operations are in progress.

Location No. 2 includes within its limits the ledge at the northwest end at G, and that on the western side of the south end of Location No. 1, aggregating 110,000 cubic yards.

This, and the fact that the estimate of total yardage so far exceeded those of Locations Nos. 1 and 3, was considered sufficient justification for not expending the time of the boring parties in further investigation of this location.

On the basis of the information possessed of this location, the improvement, if carried on along its lines, would cost \$7,618,000, and there is a strong probability that the ledge found at G extends farther into this location and that other ledge in large quantities exists under the shoals through which it passes.

The only conclusion that can be reached from these estimates is that Location No. 3 is the only feasible one for the proposed new channel. It presents no difficulties to navigation at either end, as the seaward entrance is easily reached through Broad Sound, and the turn at the inner end around Deer Island light into President Roads is on a curve with radius of about 1 mile in length.

UNIT PRICES.

The question of the unit prices to be adopted for purpose of estimating the cost of a project of such magnitude as this is a most important one and has received my earnest attention.

Information gained by inquiries that I have made among men engaged in the dredging business prompts me to state that no dredging has ever been done of the precise nature of that involved in the execution of this project.

The material to be removed is so hard in many places as to render impossible the use of the "clam shell" dredges, by which deep-water dredging can be easily performed.

The depth of water in which the dredging machines must work at high water of mean tides is about 46 feet, and in spring tides will sometimes reach 48 feet. All material must be towed to sea, a mean distance of about 9 miles.

The nature of the material will compel the use of dipper dredges, which must be held in position either on spuds or by means of heavy moorings, and the latter method is impracticable in the inner harbor channels for the reason that the immense spread required for the mooring lines would obstruct the passage of vessels through the channels.

It would therefore appear that special plant must be constructed for this work, and it is estimated that such plant of sufficient capacity to carry on the work at a rate which would insure its completion within ten years would cost \$1,000,000.

The nearest approach to a precedent from which to secure guidance in fixing unit prices is on work now going on in improvement of the main ship channel and the Broad Sound Channel in Boston Harbor.

Dredging is being carried on to a depth of 27 feet at mean low water in the main ship channel under a contract involving the removal of 3,000,000 cubic yards of material at a unit price of 17½ cents per cubic yard, and in Broad Sound Channel under a contract for dredging 800,000 cubic yards of material to a depth of 30 feet at mean low water at a price of 35 cents per cubic yard.

The increase in depth under the proposed project over that of the above-mentioned work is 8 feet in the inner harbor and 5 feet in Broad Sound; and it is my opinion that the lowest unit prices that can safely be adopted in estimating the cost of this work is 20 cents per cubic yard for the inner harbor dredging and 40 cents per cubic yard for the Broad Sound dredging.

In the upper harbor the unit price adopted for estimating cost of removal of ledge is \$15 per cubic yard. Ledge is now being removed to a depth of 27 feet at mean

low water from the main ship channel, at a contract price of \$15.80 per cubic yard, and this is the lowest price ever paid for similar work in this vicinity. It is believed, however, that on account of the heavy cutting which will be necessary in many of the ledges and which will secure better results from the plant used on the work, the work can be done at \$15 per cubic yard at the increased depth required by the new project.

The removal of the ledge from Broad Sound will be a more difficult and expensive operation, due to its exposed position.

Work on this ledge should be commenced early in the progress of operations under the project, and as a contract will have to be made for its removal alone, and the contractor will be able to work on it for only a few months during the summer season, it is believed that the price of \$40 per cubic yard is not unduly high for estimate of cost of its removal.

PLAN.

The basis of the map¹ submitted with this report is a compiled plan prepared by the Massachusetts State harbor and land commission in 1895, "from manuscript plans of soundings taken by the United States Coast and Geodetic Survey, 1892-93, corrected and brought up to date by additional information furnished by Col. S. M. Mansfield, Corps of Engineers, U. S. A., and by surveys made under the direction of the harbor and land commissioners."

This plan, corrected and brought up to date, has been used for delineation of wharf and shore lines and subsidiary channels, and the recent hydrographic surveys of Broad Sound and the upper main ship channel have been substituted for the hydrography of the original plan in these localities. Soundings of the new work are written in feet and tenths, while those taken from the original plan are written in feet only.

By this means a satisfactory map on a suitable scale has been produced for publication at the minimum expense of time and labor.

On this plan characteristic soundings of our surveys only are shown, selected from the many taken in the surveys, and no attempt has been made to show positions or give other information of the borings, as any such attempt would result in causing confusion to the eye in studying the plan, while the information is not regarded as of especial value in the general purpose for which the plan is intended.

Very respectfully, your obedient servant,

T. T. HUNTER HARWOOD,
Assistant Engineer.

Col. CHAS. R. SUTER,
Corps of Engineers, U. S. A.

¹ Not reprinted; printed in House Doc. No. 119, Fifty-sixth Congress, second session.

APPENDIX D.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS AND IN RHODE ISLAND.

REPORT OF MAJ. GEO. W. GOETHALS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|--|---|
| 1. Harbor of refuge at Hyannis, Massachusetts. | 11. Green Jacket Shoal, Providence, Rhode Island. |
| 2. Harbor of refuge at Nantucket, Massachusetts. | 12. Fall River Harbor, Massachusetts. |
| 3. Harbor at Vineyard Haven, Massachusetts. | 13. Newport Harbor, Rhode Island. |
| 4. Woods Hole Channel, Massachusetts. | 14. Harbor of refuge at Point Judith, Rhode Island. |
| 5. New Bedford Harbor, Massachusetts. | 15. Entrance to Point Judith Pond, Rhode Island. |
| 6. Taunton River, Massachusetts. | 16. Harbor of refuge at Block Island, Rhode Island. |
| 7. Sakonnet River, Rhode Island. | 17. Great Salt Pond, Block Island, Rhode Island. |
| 8. Harbor at Sakonnet Point, Rhode Island. | 18. Removing sunken vessels or craft obstructing or endangering navigation. |
| 9. Pawtucket River, Rhode Island. | |
| 10. Providence River and Narragansett Bay, Rhode Island. | |

EXAMINATIONS AND SURVEYS.

- | | |
|------------------------------------|--|
| 19. Sakonnet Harbor, Rhode Island. | 21. Ohio Reef (Ledge), Narragansett Bay, Rhode Island. |
| 20. Pawtucket River, Rhode Island. | |

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 13, 1901.

GENERAL: I have the honor to transmit herewith annual report on river and harbor works under my charge at close of fiscal year ending June 30, 1901.

Maj. D. W. Lockwood, Corps of Engineers, was in charge from July 1 to 25, 1900; First Lieut. R. P. Johnston, Corps of Engineers, was in temporary charge from July 25 to August 31, 1900; First Lieut. R. P. Johnston, Corps of Engineers, has been on duty under the direction of this office from July 1 to 25, 1900, and since August 31, 1900.

Very respectfully, your obedient servant,

GEO. W. GOETHALS,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

D I.

HARBOR OF REFUGE AT HYANNIS, MASSACHUSETTS.

The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod, about 15 miles to the westward of the heel of the cape, and is an important harbor of refuge. (For map see p. 592, Annual Report of 1884.)

The mean rise and fall of the tide is about 3.2 feet.

Original condition.—Before improvement it was an open roadstead, exposed to southerly storms.

At the adoption of the present project the 15.5 feet depth anchorage area protected by the breakwater covered only about 47 acres.

Present project.—The present project, that of 1884, provides for the deepening to 15.5 feet at mean low water, by dredging, of about 36 additional acres of protected area, to be limited on the west by a line running due north from the western end of the breakwater and on the north by a line running parallel to the breakwater and 1,500 feet from it, leaving a berm of 100 feet along the northern side of the breakwater, at a cost estimated in 1884 at \$45,743.20. A plan of the works may be found at page 260, Annual Report of the Chief of Engineers for 1885, and page 804 of 1893, and further information at page 621 of 1885.

Amount expended and results to June 30, 1900.—In the years 1827–1838 a breakwater of riprap granite 1,170 feet long was constructed, covering an anchorage of about 175 acres, the entrance to which had a depth of about 15.5 feet. In the years 1852–1882 extensive repairs were made in increasing the width of its base and the size of the stone forming its sides and top, at a cost of \$123,350. The total amount expended on the present project up to June 30, 1900, was \$43,914.02, by which 26.6 acres of the 36 had been deepened to 15.5 feet and two 25 feet wide cuts 13 feet deep at mean low tide were made in the channel leading to the wharf of the New York, New Haven and Hartford Railroad Company. A survey of the harbor was made and report thereon submitted under date of November 7, 1899, for which see page 1284, Annual Report of the Chief of Engineers for 1900.

Operations during the past fiscal year.—No operations have been in progress during the past fiscal year.

Work required to complete the existing project.—The work required to complete the existing project is the completion of the dredging to a depth of 15.5 feet over the area remaining to be deepened. The survey referred to above developed the fact that to accomplish this will require the removal of 130,000 cubic yards of material, which, at an estimated cost of 25 cents per cubic yard, makes a total cost of \$32,500.

Operations contemplated for the fiscal year ending June 30, 1902.—The unexpended balance (together with such sums as may be appropriated by Congress) will be applied to carrying out the present project.

Hyannis is in the Barnstable collection district, and Barnstable is the nearest port of entry. The amount of revenue collected at Barnstable in the last calendar year was \$732.93. The main value of the harbor is for a harbor of refuge. The nearest light-house is Hyannis light. The nearest fortification is Fort Rodman, at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1900, balance unexpended	\$1, 931. 06
June 30, 1901, amount expended during fiscal year	69. 06
July 1, 1901, balance unexpended	1, 862. 00
{ Amount (estimated) required for completion of existing project	32, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.	32, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

Previous projects.

March 2, 1827	\$10, 650. 00
April 30, 1830	6, 517. 82
March 2, 1831	8, 400. 00
July 3, 1832	7, 600. 00
March 2, 1833	5, 000. 00
June 28, 1834	10, 000. 00
March 3, 1835	9, 000. 00
March 3, 1837	5, 000. 00
July 7, 1838	8, 764. 00
August 30, 1852	5, 000. 00
July 11, 1870	12, 000. 00
March 3, 1871	10, 000. 00
March 3, 1873	10, 000. 00
June 23, 1874	5, 000. 00
June 18, 1878	3, 000. 00
March 3, 1879	2, 500. 00
March 3, 1881	5, 000. 00
Total	\$123, 431. 82

Existing project.

August 5, 1886	\$10, 000. 00
August 11, 1888	10, 000. 00
September 19, 1890	8, 000. 00
July 13, 1892	6, 000. 00
August 18, 1894	3, 500. 00
June 3, 1896	6, 000. 00
March 3, 1899	2, 162. 00
Total	45, 662. 00
Received from sale of material	20. 68
Total	169, 114. 50

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Hyannis Harbor, Massachusetts, during the calendar years ending December 31, 1895-1900, is estimated as follows (based mainly upon reports received from Messrs. T. Crocker & Sons, Hyannis, Mass.):

Class of goods.	1895.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cotton and products						20
Tobacco	15	20	10	25	26	22
Rice	2			25	20	
Grains and forage	3, 750	1, 000	900	2, 300	2, 400	2, 300
Vegetables and truck	1	300	100	100	100	125
Live stock and products	75		30	30	30	40
Fish, oysters, etc	1, 032	200	250	225	300	320
Lumber and products	2, 850	2, 500	3, 000	5, 250	5, 500	5, 500
Coal, minerals, etc	14, 500	18, 000	19, 500	18, 000	18, 500	19, 000
Fertilizers			50	50	50	50
General merchandise		2, 000	1, 000	1, 000	1, 000	1, 200
Sundries	300	200	180	180	200	225
Total	22, 525	24, 220	25, 020	27, 185	28, 126	28, 802

New transportation companies established during the year, none reported. The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	<i>Tons.</i>
Freight and passenger	65	10	300
Freight mainly	20	12	450
Passenger mainly	45	9	400
Fishing	25	6	70
Tugs	260	11	80
Pleasure boats	210	7	75
Sail:			
Freight	320	12	400
Fishing boats	350	3	6
Oyster boats	15	4	8
Pleasure boats, large	70	8	60
Pleasure boats, small	270	3	8
Barges	120	14	500

D 2.

HARBOR OF REFUGE AT NANTUCKET, MASSACHUSETTS.

Nantucket Harbor is the only well-protected harbor on Nantucket Sound between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of about 100 miles, except the small harbor of Hyannis on the other (the north) side of Nantucket Sound. The navigation of this sound is intricate and dangerous by reason of numerous shoals. Nantucket Harbor has a considerable area with a depth of water in excess of 12 feet, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod, estimated to be 50,000 annually. In the memorial to Congress on which the first appropriation for this harbor of refuge was based it was stated that more than 500 vessels had been wrecked in the vicinity of the island. (For map of harbor see p. 432, annual report of 1880, and p. 576 of report of 1885.)

The mean rise and fall of the tide is about 3 feet.

Original conditions.—At the adoption of the present project no jetties existed, and the channel entrance was barred by a shoal of 1.5 miles width on which the depth of water at low tide was only 6 feet, the channel being very crooked and subject to changes in location.

Present project.—The present approved project—that of 1880, as modified in 1885—provides for the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal current to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging, where necessary, to obtain a depth of from 12 to 15 feet at low water in this channel, all at a total cost estimated in 1885 at \$375,000.

A plan of the works may be found at page 578, Annual Report of the Chief of Engineers for 1885, and page 806 of 1893; and further information at page 436 of 1880, page 544 of 1881, page 595 of 1884, and pages 563, 575, and 578 of 1885.

Amount expended and results to June 30, 1900.—The funds appropriated from 1829 to 1844, \$45,734.75, were expended in the ineffectual dredging of an entrance channel. The amount expended on the present project up to June 30, 1900, was \$259,143.67, by which the west jetty had been built to 4,955 feet length, of which 3,955 feet length was to

full height, 400 feet to half-tide level, and the outer 600 feet to full section, and the jetty strengthened and leveled up at some points where it had settled and been somewhat washed down. The east jetty has been built up to its full height for a length of 834 feet from the shore end; then the foundation laid for a length of 191 feet; then came a gap of 160 feet; then 3,655 feet raised to half-tide level, of which 1,300 feet in length has settled and been considerably washed down (the total length from the shore end being 4,840 feet). Mounds of heavy stone were also built to protect lantern staffs near the present ends of both jetties.

The first portions of the west jetty were constructed without a core by simply placing large rough stone on the line of the jetty, which, from the small cross section of the jetty, at first triangular and later with a top width of 4 feet, offers not only many large openings for the passage of sand, but has been washed down to a considerable extent by the action of the sea and ice. This method of construction was followed in all that portion of the work built prior to 1884, and includes 3,955 feet of the length of the jetty. The construction since that time has been made with a core of small stone of varying sizes from 5 to 200 pounds in weight, protected by a facing of large stone. This has made a compact structure and one practically sand tight.

In order that the full benefit of the western jetty may be realized, it should be repaired in such a manner as to make it as nearly sand tight as possible and the top raised to its original height of 5 feet in places where it is now less.

This work could have been done much better in the first instance, but a short section near the shore end thus repaired in 1894 has stood well and presents a much better barrier to the passage of sand than any other portion of the old west jetty.

It is estimated that this would require 15,000 tons of stone at \$2 per ton, or a total of \$30,000, in addition to the estimated cost of the approved project.

In December, 1896, during an unusually severe storm, a breach was made between the ocean and the head of the harbor, at what is called the "Haulover." Reports thereon were submitted in January and February, and a more detailed report, after a careful examination of the existing conditions, was submitted in May, 1897.

The breach still remains open, but does not appear to have caused any perceptible change in the depth of water at the harbor entrance.

There is now a depth of 8 feet in the channel, which before improvement was limited to 6 feet.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$856.33.

No work was in progress beyond the maintenance of a light on the outer end of each jetty up to April, 1901, when, from lack of funds for the maintenance of these lights, their care was transferred to the Light-House Board.

For dimensions of jetty and method of construction, see Annual Report of the Chief of Engineers for 1896, Part I, page 627.

There is a gap in the east jetty about 191 feet from shore end, where no stone has ever been placed. This gap is 160 feet long and is now about 16 feet deep. In my opinion this gap should be closed and, together with the next 1,500 feet, be built up to full height, as projected. The bottom between the jetties is covered in places with patches of

marine growth, locally termed "hog beds," which materially affect the navigable depth. These patches prevent the wash of sand, and the difference in depth over them and alongside is often from 1 foot to 18 inches. These should be removed, but whether this can be done by dragging can only be determined by experiment. If not by dragging, then a dredge will be needed to remove them.

Work required to complete the existing project.—The work required to complete the existing project is the raising of the incomplete parts and the further extension of both jetties, and the excavation, by dredging, of so much of the channel as may not be deepened by tidal scour.

Operations contemplated for the fiscal year ending June 30, 1902.—Future operations will depend upon appropriations to be made by Congress.

Nantucket is in the Nantucket collection district, and is a port of entry. The amount of revenue collected at Nantucket in the last calendar year was \$16. The value of the harbor is mainly as a harbor of refuge. The nearest light-houses are Nantucket Cliff and Brant Point lights. The nearest fortification is that of Fort Rodman, at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1900, balance unexpended	\$856.33
June 30, 1901, amount expended during fiscal year	856.33
{ Amount (estimated) required for completion of existing project	115,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$100,000.00
For maintenance of improvement.....	15,000.00
	115,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNTS APPROPRIATED.

Previous projects.

May 23, 1825, survey	\$300.00
March 2, 1829	30,000.00
March 2, 1831	8,265.00
July 3, 1832	6,000.00
June 14, 1844	1,169.75
Total	\$45,734.75

Existing project

July 14, 1880	\$50,000.00
March 3, 1881	25,000.00
August 3, 1882	25,000.00
July 5, 1884	10,000.00
August 5, 1886	15,000.00
August 11, 1888	20,000.00
September 19, 1890	25,000.00
July 13, 1892	25,000.00
August 18, 1894	25,000.00
June 3, 1896	20,000.00
March 3, 1899	20,000.00
	260,000.00
Total	305,734.75

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Nantucket Harbor, Massachusetts, during the calendar years ending December 31, 1895–1900, is estimated as follows (based mainly upon reports received from various citizens of Nantucket):

Class of goods.	1895.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Tobacco	40	40	35	30	30	35
Rice	2	3	4	5	5	5
Grains and forage	371	390	400	380	390	1,520
Vegetables and truck	415	340	325	350	350	400
Live stock and products	5	6	10	10	10	20
Fish, oysters, etc.	500	400	500	600	650	750
Naval stores	8	3	2	3	3	5
Lumber and products	1,000	1,200	1,400	1,500	1,500	2,500
Coal, minerals, etc.	7,000	8,000	10,000	12,000	12,500	14,000
Fertilizers	480	16	25	50	50	75
Machinery	30	2,000	1,500	1,000	1,000	2,000
General merchandise	1,560	1,600	2,000	2,000	2,100	2,500
Sundries	213	500	500	500	500	600
Total	11,624	14,438	16,701	18,428	19,088	24,410

New transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows, each entrance and departure together being counted as one:

Character or class of service.	Number.	Average draft.	Average Tonnage.
		<i>Fect.</i>	<i>Tons.</i>
Steam:			
Freight and passenger	500	8	500
Freight mainly	15	7	100
Passenger mainly	42	7	200
Fishing	2	5	6
Tugs	25	5	6
Pleasure boats	35	6	5
Sail:			
Freight	20	7	6
Fishing boats	45	4	5
Oyster boats	2	3	3
Pleasure boats, large	100	5	6
Pleasure boats, small	350	4	3

D 3.

IMPROVEMENT OF VINEYARD HAVEN HARBOR, MASSACHUSETTS.

Vineyard Haven is a deep indentation in the northern shore of the island of Marthas Vineyard, on the southern side of Vineyard Sound. It is triangular in form and faces the northeast. The width of the mouth of the harbor, or the distance between the points of land on the east and west sides of the entrance, known as East Chop and West Chop, is about 1.25 miles, and from a line connecting the chops to the narrow southerly end of the harbor, at which is situated the town of Vineyard Haven, the distance is about 1.75 miles. The entire area of the harbor between the shore lines is about 949 acres, of which some 657 acres have a depth of not less than 15 feet. The mean rise and fall of the tide is 1.7 feet.

Original condition.—At the mouth of the harbor the wearing away of the chops by the action of the waves in storms had been noted for many years. The former site of a light-house on West Chop had entirely disappeared. The débris was carried by the current into the harbor, where it formed shoals, which were gradually impairing the

anchorage capacity, especially in the upper part of the harbor. (For map of harbor see page 580 of annual report of 1887.)

Plan of improvement.—The present approved project, that of 1887 as modified in 1889, provides for the protection of the chops (or headlands) from erosion and the intervening harbor from being filled by the eroded material, the whole to be done by means of stone sea walls and jetties to be built along the beach in front of the bluffs at both headlands, all at a total cost estimated in 1889 at \$60,000.

A description of the work may be found at page 594, Annual Report of the Chief of Engineers for 1882, page 577 of 1887, and page 612 of 1889, and a map of the same at page 812 of 1893.

Amount expended and results to June 30, 1900.—The amount expended to June 30, 1900, was \$54,304.26, by which there had been built a sea wall 1,210 feet long, a jetty 50 feet long, and six small spurs extending back from the sea wall to the foot of the bluff on the East Chop; a sea wall 880 feet long and three jetties, 150, 135, and 280 feet long, respectively, a wharf and a short stone breakwater 60 feet in length near the end of the wharf on the West Chop, and 2,400 feet length of riprap wall along the low-water line in front of the bluff on the east side of the West Chop. The river and harbor act of March 3, 1899, provided for an examination of "Vineyard Haven, Mass., with a view to its further protection and improvement as a harbor of refuge by a breakwater or otherwise." The report of this examination was submitted under date of September 13, 1899, and printed in Annual Report of Chief of Engineers for 1900 at page 1289.

For dimensions of walls and details of construction see Annual Report of Chief of Engineers for 1896, Part I, page 632.

Operations during the past fiscal year.—No works of improvement were in progress during the past fiscal year.

Work required to complete the existing project.—The project, so far as the shore protection is concerned, is completed, but certain repairs are needed to maintain the work in a serviceable condition.

Operations contemplated for the fiscal year ending June 30, 1902.—It is proposed to apply the balance of funds to repairing existing works.

Vineyard Haven is in the Edgartown collection district. Edgartown is the nearest port of entry. The amount of revenue collected at Edgartown in the last calendar year was \$626.46. The nearest light-houses are those on East and West Chops. The nearest fortification is that of Fort Rodman, at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1900, balance unexpended	\$5, 695. 74
June 30, 1901, amount expended during fiscal year	663. 09
July 1, 1901, balance unexpended	5, 032. 65

AMOUNTS APPROPRIATED.

Existing project.

April 11, 1888	\$25, 000	June 3, 1896	\$7, 000
September 19, 1890	10, 000	March 3, 1899	3, 000
July 13, 1892	7, 500		
August 18, 1894	7, 500	Total	60, 000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Vineyard Haven Harbor, Massachusetts, by water during the calendar years ending December 31, 1895-1900, is estimated as follows (based mainly upon reports received from Mr. C. J. Doherty, Weather Bureau Service, Vineyard Haven, Mass.):

Class of goods.	1895.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cotton and products.....	35	60	50	50	50	50
Tobacco.....	16	5	7	7	12	20
Rice.....	50	30	30	30	35	40
Grain and forage.....	1,100	2,000	2,000	2,000	2,200	2,200
Vegetables and truck.....	30	30	30	30	40	60
Live stock and products.....	150	200	150	150	175	300
Fish, oysters, etc.....	700	1,500	1,500	1,500	2,000	2,500
Naval stores.....	10	20	15	15	15	15
Lumber and products.....	900	3,000	10,000	12,000	15,000	18,000
Coal, minerals, etc.....	47,000	48,000	50,000	75,000	90,000	90,000
Fertilizers.....	40	100	75	100	100	500
Machinery.....	50	50	55	60	65	50
General merchandise.....	8,500	6,000	7,450	7,500	8,000	9,000
Sundries.....		1,500	1,500	1,500	2,000	2,000
Total.....	58,581	62,515	73,862	99,942	119,692	124,740

New transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steam:			
Freight and passenger.....	1,000	7	250
Freight mainly.....	750	17	1,500
Passenger mainly.....	60	7	250
Fishing.....	100	11	150
Tugs.....	800	14	200
Pleasure boats.....	600	8	50
Sail:			
Freight.....	2,000	19	1,300
Fishing boats.....	1,000	11	125
Oyster boats.....	10	12	25
Pleasure boats, large.....	500	13	100
Pleasure boats, small.....	1,500	5	50
Barges.....	2,000	18	1,200

D 4.

IMPROVEMENT OF WOODS HOLE CHANNEL, MASSACHUSETTS.

This harbor is on the north side of Vineyard Sound, and is divided into Great Harbor and Little Harbor. The name of Woods Hole is also applied to the adjoining strait or channel which connects the waters of Buzzards Bay with Vineyard Sound and separates the chain of islands, known as Elizabeth Islands, from the southwestern extremity of the peninsula of Cape Cod.

Original condition.—Before improvement the entrance to Little Harbor was obstructed by a bar with but 7.5 feet of water on it at mean low water. Great Harbor has ample depth. The site of the wharves and basins of the United States Fish Commission and Revenue Marine was a submerged point of land extending from the shore of the harbor. In the strait the channels were crooked and obstructed by numerous boulders, and the velocity of the currents at certain stages of the tide was from 5 to 7 miles per hour.

Plans of improvement.—The project of 1879 provided for making a

channel through the bar at the entrance to Little Harbor and widening and deepening the channel in the strait. The project of 1883, extended in 1884 and 1886, provided for the construction of a retaining wall on the shore, a hollow pier and wharves for the use of the United States Fish Commission, and to serve also as a coaling station for vessels of the Revenue Marine and other branches of the public service and as a harbor of refuge, all of which was completed in 1888. In the project of 1895, which is the present approved project, it is proposed to give the channel through the strait and its southeastern branch a width of 300 feet and a low-water depth of 13 feet, at an estimated cost of \$396,000.

Amounts expended and results up to June 30, 1900.—The amount expended up to June 30, 1900, was \$153,571.98. The first appropriation—that of 1852—was expended in building a breakwater, which proved beneficial by arresting an influx of sand into Great Harbor. With the appropriation of 1879 the depth of water at entrance to Little Harbor was increased from 7.5 to 10 feet, and a direct channel made, 120 feet wide and 9 feet deep, through the strait, benefiting greatly the commerce passing through it. The wharves and piers were completed in 1888, and a breach, made in the east pier wall by storms, and the wharves, were repaired in 1895. A survey of the strait and Little Harbor was made, and report, with project and estimate for further improvement, was submitted August 17, 1895. (See p. 72 and p. 750, Annual Report of Chief of Engineers, 1895.) The work of deepening the channel through the strait has been carried on during two seasons and has resulted in the removal of all obstructing shoals to a depth of 13 feet at mean low water in the southern half of the channel between its eastern end and the southern branch, known as "Broadway," of the greater portion of the shoal at the junction of the two branches of the channel, and of a shoal in mid-channel just west of the junction.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$17.94.

No operations of improvement were in progress during the year, the expenditures noted being for contingencies.

Work required to complete the existing project.—The work required to complete the existing project is the widening and deepening of the channel through the strait.

Operations contemplated for the fiscal year ending June 30, 1902.—It is proposed to expend funds as made available in first completing the southern half of the channel and then widening the 13 feet depth to the northward until the full width is secured as appropriations are made by Congress.

Woods Hole is in the Barnstable collection district. New Bedford is the nearest port of entry. The amount of revenue collected in the last calendar year was, at Barnstable, \$723.93, and at New Bedford, \$82,934.28. The nearest light-house is Nobska light. The nearest fortification is that of Fort Rodman, at Clark Point, New Bedford, Mass.

Money statement.

July 1, 1900, balance unexpended	\$17.94
June 30, 1901, amount expended during fiscal year	17.94

Amount (estimated) required for completion of existing project	356,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	150,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

August 10, 1852.....	\$25,000.00
March 3, 1879.....	15,000.00
August 2, 1882.....	52,000.00
July 5, 1884.....	25,000.00
August 5, 1886.....	14,500.00
March 2, 1895.....	5,000.00
June 3, 1896.....	20,000.00
March 3, 1899.....	20,000.00
Total.....	154,000.00
December 5, 1895, unexpended balance deposited to the credit of the Treasurer of the United States.....	400.08
Total.....	153,599.92

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Woods Hole, Mass., by water during the calendar years ending December 31, 1895-1900, is estimated as follows (based mainly upon reports received from Mr. Walter O. Luscombe, of Woods Hole, Mass.):

Class of goods.	1895.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Grains and forage.....	2,265	3,000	3,500	3,500	3,500	3,850
Vegetables and truck.....	8	9	15	25	26	27
Live stock and products.....	150	150	170	200	200	220
Fish, oysters, etc.....	225	200	210	250	300	330
Naval stores.....	5	15	28	40	40	44
Lumber and products.....	4,000	3,900	4,000	5,000	6,000	6,600
Coal, minerals, and products.....	4,000	5,000	5,500	6,000	6,000	6,600
Fertilizers.....	50	75	200	250	250	275
General merchandise.....	1,082	1,200	1,200	1,200	1,200	1,320
Total.....	11,785	13,549	14,823	16,465	17,515	19,266

New transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Fect.</i>	<i>Tons.</i>
Steam:			
Freight and passenger.....	400	10	900
Freight mainly.....	100	7	25
Passenger mainly.....	200	11	50
Fishing.....	50	8	30
Tugs.....	40	10	100
Pleasure boats.....	100	10	100
Sail:			
Freight.....	100	8	150
Fishing boats.....	175	8	50
Pleasure boats, large.....	50	4	15
Pleasure boats, small.....	200	3	5

D 5.

IMPROVEMENT OF NEW BEDFORD HARBOR, MASSACHUSETTS.

New Bedford Harbor is an estuary of Buzzards Bay and is the port of the cities of New Bedford and Fairhaven, Mass. New Bedford is an important port of entry. It is largely interested in manufactures, those of cotton predominating, and has an extensive commerce in

addition to its whale fisheries. The population of New Bedford in 1900 was about 62,400.

The mean rise and fall of the tide is about 4.2 feet.

Original condition.—Before improvement the channel had a ruling depth of about 12.5 feet at mean low water.

At the adoption of the present project the channel was winding and about 15 feet deep.

Plan of improvement.—The project of 1887 which provided for a channel 200 feet wide and 18 feet deep at mean low water from Buzzards Bay to New Bedford, at an estimated cost of \$35,000, has been completed. The present approved projects are those of 1895, providing for dredging an anchorage area one-half mile long, 600 feet wide, and 18 feet deep at mean low water, on the north side of the channel leading from New Bedford to Fairhaven, at an estimated cost of \$57,689.33, and of 1899, providing for dredging a channel 250 feet wide and 18 feet deep at mean low water from the anchorage area through the new drawbridge between Fish and Popes islands to the deep water above, at an estimated cost of \$34,000.

A description of the works may be found at page 514, Annual Report of the Chief of Engineers for 1888, and a plan of the same in House Ex. Doc. No. 86, Fiftieth Congress, first session, and at page 816, Annual Report for 1893; also at page 672, Annual Report for 1896, and in House Doc. No. 59, Fifty-fourth Congress, first session, and in House Doc. No. 146, Fifty-fourth Congress, second session.

Amount expended and results up to June 30, 1900.—The total amount expended to June 30, 1900, was \$126,693.41, of which \$17,691.37 were expended in 1836–1839 in removing a wreck and dredging the sand bar which had been formed by it; \$20,000 were expended in 1875 to 1877 in completing a channel 300 feet wide and 15 feet deep from the deep water above Palmers Island to the wharves of New Bedford, and \$88,942.04 since 1888 in deepening the channel to 18 feet at mean low water for a width of 200 feet from the wharves in New Bedford to the deep water of Buzzards Bay; in adding 18.4 acres by dredging to the 18-foot anchorage area in the upper harbor, and in dredging a channel 250 feet wide and 18 feet deep at mean low tide from the anchorage area through the new drawbridge between Fish and Popes islands to the deep water above. Owing to the very soft character of the material through which the lower portion of this channel passes, there has been some inflow along the western side of a portion of the channel, and the full depth of 18 feet at mean low tide has not been maintained throughout. It is estimated that an expenditure of \$10,000 will be required for redredging in order to maintain the 18-foot depth for the full projected width of the channel.

A survey was made of a portion of the harbor adjacent to the New Bedford wharf line and above and below the old drawbridge, with a view to securing additional data upon which to base an estimate of the cost of further improvement, and report thereon was submitted in November, 1899, and is printed in Annual Report of Chief of Engineers for 1900, at page 1295.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$6.96.

No works of improvement were in operation during the year, the expenditures being for contingencies.

The work required to complete the existing projects.—The work required to complete the existing projects is the completion of the anchorage area.

Operations contemplated for the fiscal year ending June 30, 1902.—Future operations will depend on appropriations made by Congress.

New Bedford is in the New Bedford collection district and is a port of entry. The amount of revenue collected in the last calendar year was \$82,934 28. The nearest light-houses are Clark Point light and the lights in New Bedford Harbor. The nearest fortification is Fort Rodman, at Clark Point, Massachusetts.

Money statement.

July 1, 1900, balance unexpended	\$6. 96
June 30, 1901, amount expended during fiscal year	6. 96
{ Amount (estimated) required for completion of existing project	37, 689. 33
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	37, 689. 33
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

July 4, 1836.....	\$10, 000. 00
July 7, 1838.....	7, 691. 37
March 3, 1875.....	10, 000. 00
August 14, 1876.....	10, 000. 00
August 11, 1888.....	10, 000. 00
September 19, 1890.....	10, 000. 00
July 13, 1892.....	7, 500. 00
August 18, 1894.....	7, 500. 00
June 3, 1896.....	10, 000. 00
March 3, 1899.....	44, 000. 00
Total	126, 691. 37
Received from sale of material	9. 00
Total	126, 700. 37

COMMERCIAL STATISTICS.

The commerce arriving at and leaving New Bedford, Mass., by water during the calendar years 1896–1900 is estimated as follows (based mainly upon reports received from Mr. George F. Bartlett, collector of customs, New Bedford, Mass.):

Class of goods.	1896.	1897.	1898.	1899.	1900.
Cotton and products.....	22, 400	15, 000	25, 000	25, 500	23, 600
Tobacco.....	50	40	50	100	75
Grain and forage.....	15, 000	20, 000	15, 000	15, 000	16, 500
Vegetables and truck.....	7, 100	5, 000	7, 000	7, 000	6, 400
Live stock and products.....	500	400	500	500	400
Fish, oysters, etc.....	3, 250	2, 500	3, 000	3, 500	6, 000
Naval stores.....		25	20	20	1, 000
Lumber and products.....	33, 500	35, 000	30, 000	22, 000	28, 500
Coal, minerals, and products.....	650, 000	500, 000	470, 000	435, 000	470, 000
Fertilizers.....	150	200	1, 200	1, 500	1, 600
General merchandise.....	100, 000	75, 000	73, 500	80, 000	85, 000
Sundries.....	10, 000	15, 000	10, 000	12, 000	12, 800
Total	659, 423	668, 165	635, 270	653, 120	651, 875

New transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steam:			
Tugs.....	625	8	50
Freight and passenger	725	8	560
Freight mainly.....	450	16	900
Passenger mainly.....	500	8	60
Fishing boats.....	100	6	12
Pleasure boats.....	200	8	50
Sail:			
Freight.....	1,030	14	1,000
Fishing boats.....	600	5	12
Pleasure boats, large.....	250	11	150
Pleasure boats, small.....	1,000	5	10
Barges.....	421	13	1,000

D 6.

IMPROVEMENT OF TAUNTON RIVER, MASSACHUSETTS.

This river rises in Norfolk County, Mass., and empties into Mount Hope Bay, a part of Narragansett Bay. It is about 44 miles in length.

The object of the improvement is to deepen and widen the channel so that vessels of 11 feet draft can, at high water, go up to the city of Taunton, which, for its extensive manufactures, requires large quantities of coal, iron, clay, molding sand, and other heavy articles. The rise and fall of the tide before improvement was 5.25 feet at Dighton and 3.4 feet at Taunton.

Original condition.—In its original condition the channel was narrow and obstructed by bowlders, and from Berkley Bridge to Taunton its depth was not, in places, more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton.

At the adoption of the present project the channel was limited to 9 feet at high water, and was too narrow and too much obstructed by bowlders for easy navigation by the craft making use of it.

Plan of improvement.—The present approved project, that of 1880, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet at high water, with 100 feet width from its mouth up to Berkley Bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs Shoal; thence 11 feet depth with the same width up to the shipyard; thence 11 feet depth with 60 feet width up to the Weir Bridge, Taunton; all at a total cost estimated in 1893 at \$125,000.

A plan of the works may be found at page 606, Annual Report of the Chief of Engineers for 1884, and page 824 of the annual report for 1893; and a later, more detailed plan in House Ex. Doc. No. 86, Fiftieth Congress, first session; and further information at page 373 of the annual report for 1880, page 519 of the annual report for 1888, and page 823 of the annual report for 1893.

Amount expended and results to June 30, 1900.—The total amount expended up to June 30, 1900, was \$187,999.81. The \$63,000 appropriated from 1870 to 1879 secured a depth of 9 feet at high water up to the head of navigation. (See page 375, annual report for 1880.) By the expenditure of the subsequent appropriations the proposed

work had been practically completed, so that there was a fairly good channel with a minimum depth of 11 feet at high water from the head of navigation to Narragansett Bay, which, however, needed widening at a few points below Berkley Bridge.

Operations during the past fiscal year.—No work of improvement was in progress during the past fiscal year.

Work required to complete the existing project.—There remains to complete the existing project the widening and deepening of the channel below Berkley Bridge and the removal of a small amount of ledge rock. In addition to this, about \$5,000 every four years will be required to maintain the dredged channel.

Operations contemplated for the fiscal year ending June 30, 1902.—It is proposed to continue the widening and deepening of the channel at the narrow and shoal places as appropriations are made by Congress.

Taunton River is in the Fall River collection district. Fall River is the nearest port of entry. The amount of revenue collected at Fall River in the last calendar year was \$5,894.58. The nearest light-house is the Borden Flat light-house. The nearest fortification is Fort Adams, Newport Harbor, Rhode Island.

Money statement.

July 1, balance unexpended.....	\$0. 19
June 30, 1901, amount expended during fiscal year	. 19
{ Amount (estimated) required for completion of existing project.....	5, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNTS APPROPRIATED.

Previous projects.

July 11, 1870.....	\$10, 000
March 3, 1871.....	10, 000
June 10, 1872.....	10, 000
March 3, 1873.....	10, 000
June 23, 1874.....	10, 000
March 3, 1875.....	10, 000
June 18, 1878.....	2, 000
March 3, 1879.....	1, 000
	\$63, 000

Present project.

July 14, 1880.....	17, 500
March 3, 1881.....	25, 000
August 2, 1882.....	25, 000
July 5, 1884.....	26, 500
September 19, 1890.....	7, 000
July 13, 1892.....	7, 000
August 18, 1894.....	5, 000
June 3, 1896.....	5, 000
March 3, 1899.....	7, 000
	125, 000
Total.....	
	188, 000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Taunton River, Massachusetts, by water during the calendar years ending December 31, 1894-1896 and 1898-1900, is estimated as follows (based mainly upon reports received from the Staples Coal Company, Taunton, Mass.):

Class of goods.	1894.	1895.	1896.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cotton and products.....	8,750	9,188	8,500	9,000	9,200	8,750
Grains and forage.....	47,300	49,665	47,000	51,000	54,000	50,000
Lumber and products.....	21,000	22,050	24,000	25,500	28,000	25,000
Coal, minerals, and products.....	390,000	409,500	410,000	450,000	475,000	480,000
General merchandise.....			500	1,000	1,200	1,500
Sundries.....	10,000	10,500	10,000	11,200	12,000	12,000
Fish, oysters, etc.....						30
Total.....	477,050	500,903	500,000	547,700	579,400	577,280

New transportation companies established during the year, none.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steam tugs.....	525	7	50
Sail (freight).....	700	9	200
Barges.....	800	9	900

D 7.

IMPROVEMENT OF SAKONNET RIVER, RHODE ISLAND.

The Sakonnet River is an arm of the sea between the island of Rhode Island and the mainland, extending from the ocean to Mount Hope Bay around the head of Rhode Island. The entrance from the ocean is unobstructed, and formerly the entire river from Narragansett Bay to the ocean was navigable for the largest ships.

At present the upper end of the river is obstructed by two bridges or causeways, the northern one belonging to the New York, New Haven and Hartford Railroad Company and the other owned by the State of Rhode Island. These causeways have draws of insufficient capacity, and the approved project of July, 1896, proposed to increase the width and the depth of the draw opening through the causeway owned by the State from 35 feet, present width, to 100 feet, and from 9 feet, present depth, to 25 feet at mean low water.

For fuller description of the subject, see Annual Report of the Chief of Engineers for 1895, pages 729 to 737.

No work has been done and no funds expended during the past fiscal year, owing to the fact that the State assembly's permission to the United States to widen and deepen the draw opening in its bridge is conditioned in such a way as to make it inoperative until the railroad company shall have widened and deepened the draw opening of its bridge.

Notice was received in May, 1898, that the New York, New Haven and Hartford Railroad Company had been ordered by the Secretary of War to construct a suitable draw in its bridge by May 1, 1899.

The time for completing the new draw in the railroad bridge was subsequently extended to May 1, 1900, and afterwards to May 1, 1901, at which date the new drawbridge and approaches to it had been completed and were in use by the railroad company. The full depth of 25 feet has since been dredged, though the depths in the new channel have not as yet been verified.

Under date of March 5, 1901, the Secretary of War addressed a communication to the governor of Rhode Island, stating that under existing legislation "it will not be possible for the War Department to avail itself of the permission and commence the work of enlarging the draw opening through the stone bridge, for the reason *that such work involves the total destruction of the bridge and highway, while no provision is made for rebuilding the one and restoring the other,*" and suggests "that the subject be brought to the attention of the general assembly, with recommendation for such legislation as will enable this Department to commence and carry out the work of improvement authorized by Congress."

The general assembly adjourned without taking the desired action.

Sakonnet River is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was \$27,372.87. The nearest light-houses are Muscle Bed Shoals, Bristol Ferry, and Warwick light-houses. The nearest fortification is Fort Adams, R. I.

Money statement.

July 1, 1900, balance unexpended.....	\$40,000.00
July 1, 1901, balance unexpended.....	40,000.00

AMOUNTS APPROPRIATED.

June 3, 1896	\$20,000
March 3, 1899.....	20,000
Total	40,000

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Sakonnet River, Rhode Island, during the calendar years ending December 31, 1896-1900, is estimated as follows (based upon reports received from Mr. J. A. Pettery, general manager of the Sakonnet Steamboat Company):

Class of goods.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Tobacco		3	4	5	4 $\frac{1}{2}$
Rice		2	2	2	2
Grains and forage	2,100	2,500	2,450	4,120	5,362
Vegetables and truck.....	10	50	65	115	237
Live stock and products.....	25	40	25	30	32
Fish, oysters, etc.....	200	300	410	630	1,137
Naval stores			40	40	
Lumber and products	350	430	850	950	837
Coal, minerals, etc. a.....	650	750	4,536	5,450	6,338
Fertilizers	5	45	60	90	270
Machinery	5	10	12	20	27
General merchandise.....	300	400	450	610	760
Sundries	15	25	30	30	35
Total	3,660	4,555	8,934	12,092	15,041 $\frac{1}{2}$

a The large increase in item of "Coal, minerals, etc.," is due to the establishment of a power station for the Newport and Fall River Street Railway system.

New transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	<i>Tons.</i>
Freight and passenger	2	8	150
Fishing.....	43	9	250
Sail:			
Pleasure boats, small	200	3	2
Pleasure boats, large	2	8	80
Barges.....	8	18	600

D 8.

IMPROVEMENT OF SAKONNET POINT HARBOR, RHODE ISLAND.

Sakonnet Point is a rocky headland on the eastern side of the mouth of Sakonnet River, and lies about 6 miles east of Newport.

Original condition.—Before improvement, Sakonnet Point, in connection with Church's Cove, just north of it, formed an anchorage protected from the southeast to northeast but exposed to storms from the south to northwest. In 1827 a project was prepared for a breakwater 400 feet long at this point, and about 200 feet of this was built at that time.

Plan of improvement.—The present project, that of 1897, approved by river and harbor act of March 3, 1899, provides for prolonging the old breakwater out to a rock nearly north of it and raising the whole to a height of 8 feet above mean low water. Reports of preliminary examinations of the locality may be found in the Annual Reports of the Chief of Engineers for 1889, page 649, and for 1895, page 749, and a description of the proposed work at page 935 of the same report for 1897. The report of survey, with map, was printed in House Ex. Doc. No. 81, Fifty-fifth Congress, first session.

Amount expended and results to June 30, 1900.—The amount expended up to June 30, 1900, was \$14,721.21 and the breakwater was nearly completed.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$10,278.79.

Stone to the amount of 1,660 tons was placed in the breakwater, making a total of 18,405 tons, thereby completing the work on July 13.

A survey of certain rocks obstructing the free navigation of the harbor and an estimate of the cost of their removal was made, and a report thereon submitted under date of November 19, 1900, which was printed as House Doc. No. 99, Fifty-sixth Congress, second session.

This work was in the local charge of Mr. Edward Parrish as assistant engineer, with Mr. Kneeland P. Partelow as inspector.

Work required to complete the existing project.—No further work required.

Sakonnet Point is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was \$27,372.87. The nearest light-house is Sakonnet Point light-house. The nearest fortification is Fort Adams, R. I.

Money statement.

July 1, 1900, balance unexpended.....	\$10, 278. 79
June 30, 1901, amount expended during fiscal year	10, 278. 79

AMOUNT APPROPRIATED.

March 3, 1899	\$25, 000
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For the commercial statistics, see report of Sakonnet River, Rhode Island.

D 9.

IMPROVEMENT OF PAWTUCKET (SEEKONK) RIVER, RHODE ISLAND.

The navigable part of the Pawtucket River, an arm of Providence River, extends from Providence to Pawtucket, a city which in 1900 had a population of about 39,000 and extensive manufactures depending largely on water transportation. The mean rise and fall of the tide is about 5 feet.

Original condition.—Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water.

At the adoption of the present project the channel was narrow and only about 7 feet deep.

Plan of improvement.—The present approved project, that of 1883, provides for deepening of the river so as to secure a channel of at least 12 feet depth at low water with 100 feet width from its mouth at Providence up to opposite Grant & Co.'s wharf, at Pawtucket, and thence 12 feet depth with 40 feet width through a stone ledge for a short distance toward Division Street Bridge. A modification of this plan approved by the river and harbor act of March 3, 1899, provides for the straightening of the channel between Ten-mile River and Bucklins Island, bringing it nearer to the eastern bank of the river, all at a total cost estimated in 1900 at \$451,937.

A plan of the works may be found at page 608, Annual Report of the Chief of Engineers for 1884, and page 830 of 1893, and further description at page 677 of 1895.

Amount expended and results up to June 30, 1900.—The total amount expended up to June 30, 1900, was \$282,171.96.

The \$52,000 appropriated between 1867 and 1882 had dredged the channel to 75 feet width and 7 feet depth at low water. This work was completed in 1876.

The expenditure of subsequent appropriations had dredged the channel to 100 feet width and 12 feet depth as far as projected and removed the ledge from the channel 40 feet wide and 12 feet deep in front of the wharves at Pawtucket. Nearly one-half of the work of straightening the channel between Ten-mile River and Bucklins Island had been done; work upon this portion of the project was in progress at the close of the fiscal year. A small amount of dredging had also been done between the piers of Central or Red Bridge, near the lower end of the improved channel, while the city of Providence was rebuilding the bridge, making the water there 20 feet deep and largely increasing the waterway through it.

The main channel has somewhat filled up near its banks.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$25,347.63.

The work in progress at the beginning of the fiscal year was continued until October 15, when the contract was completed. There were removed 133,145 cubic yards of mud and sand, making a total under the contract of 241,983 cubic yards and leaving about 400 feet in length of the channel incomplete.

This work was in the local charge of Mr. Edward Parrish as assistant engineer, with Messrs. John F. Parks, Arthur J. Ober, and George H. Winchell as inspectors.

Work required to complete the existing project.—The work yet to be done is to complete the straightening of the channel in the lower part of the river and to deepen it at points where it has shoaled.

Operations contemplated for the fiscal year ending June 30, 1902.—It is proposed to straighten and deepen the channel in its lower portions as funds are appropriated by Congress.

Pawtucket is in the collection district of Providence, and that port is the nearest port of entry. The amount of revenue collected in Providence in the last calendar year was \$324,121.06. The nearest light-house is Sassafras Point light. The nearest fortifications are Fort Adams, Newport, R. I., and Fort Greble, on Dutch Island, Rhode Island.

Money statement.

July 1, 1900, balance unexpended	\$25,347. 63
June 30, 1901, amount expended during fiscal year	25, 347. 63

{ Amount (estimated) required for completion of existing project.....	28, 580. 35
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	28, 580. 35
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

March 2, 1867	\$17, 000. 00	July 13, 1892	\$35, 000. 00
July 11, 1870	8, 000. 00	August 18, 1894	25, 000. 00
March 3, 1871	7, 000. 00	June 3, 1896	20, 500. 00
June 10, 1872	10, 000. 00	March 3, 1899	30, 000. 00
March 3, 1873	10, 000. 00		
July 5, 1884	50, 000. 00	Total	307, 500. 00
August 5, 1886	30, 000. 00	Received from sale of material	19. 59
August 11, 1888	35, 000. 00		
September 19, 1890	30, 000. 00	Total	307, 519. 59

Contract in force.

Contractor.	Date of approval.	To commence.	To complete.	Rate per cubic yard for dredging.
J. S. Packard.....	Oct. 14, 1899	Nov. 1, 1899	Nov. 1, 1900	Cents. 14 $\frac{1}{2}$

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Pawtucket River, Rhode Island, by water during the calendar years ending December 31, 1895-1900, is estimated as follows (based mainly upon reports received from the Newell Coal and Lumber Company of Pawtucket, R. I.):

Class of goods.	1895.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cotton and products.....				130	130	
Lumber and products.....	8,620	9,000	9,000	8,000	8,000	9,550
Coal, minerals, etc.....	175,447	175,000	175,000	180,000	190,000	191,200
Fertilizers.....	1,099	1,000	1,000	1,000	200	430
General merchandise.....	10,308	11,500	10,000	10,000	7,500	7,660
Sundries.....		5,000	5,000	5,000	8,000	7,220
Total.....	195,474	201,500	200,000	204,130	213,830	216,060

New transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Fect.</i>	<i>Tons.</i>
Steam:			
Freight, mainly.....	275	10	500
Passenger, mainly.....	300	8	100
Tugs.....	550	7	80
Miscellaneous.....	125	5	50
Sail:			
Freight.....	180	10	300
Pleasure boats, large.....	25	7	100
Pleasure boats, small.....	330	3	4
Barges.....	130	10	500

D 10.

IMPROVEMENT OF PROVIDENCE RIVER AND NARRAGANSETT BAY, RHODE ISLAND.

Providence River is an estuary of Narragansett Bay. The object of its improvement is to furnish a wide and deep channel for European and coastwise commerce from the ocean to Providence, a city which had in 1900 about 328,700 inhabitants, being a city largely engaged in manufactures, and also a port of entry for an extensive region of country with which it is connected by railroads. The mean rise and fall of the tide is 4.7 feet.

Original condition.—Before the improvement of the river was commenced in 1853 many shoals obstructed navigation, and at one point in the channel, a place called "The Crook," the available low-water depth was but 4.5 feet.

Plans of improvement.—The projects between 1852 and 1873 provided for deepening the channel by removing obstructing rocks and dredging at the shoalest points to secure first a depth of 9 feet and then 12 feet. This work was completed in 1878. The project of 1878 as modified in 1882 provided for a channel 300 feet wide and 25 feet deep from Providence to the deep water of Narragansett Bay and for an anchorage basin between Fox Point and Fields Point with a depth of 20 feet, 600 feet wide; a depth of 18 feet, 725 feet wide; a depth of 12 feet, 940 feet wide, and a depth of 6 feet, 1,060 feet wide; all at a

total estimated cost in 1882 of \$675,000. This project was completed in 1895.

The river and harbor act of June 3, 1896, provided for securing a ship channel 400 feet in width and of a depth of 25 feet at mean low water from Sassafras Point, in Providence Harbor, through Providence River and Narragansett Bay, by the most direct route practicable to the ocean by way of the "Western Passage," so called, at an estimated cost of \$732,820. Work under this project is now in progress.

For historical data connected with this improvement see page 1257, Annual Report of Chief of Engineers for 1900.

A plan of the old works may be found at page 622, Annual Report of the Chief of Engineers for 1884, page 830 of 1893, and further special information at page 235 of 1878 and page 557 of 1882.

Amount expended and results to June 30, 1900.—The amount expended up to June 30, 1900, was \$893,023.79, by which a channel 400 feet wide and 25 feet deep was secured up to Sassafras Point in Providence Harbor and thence 300 feet wide with the same depth up to the city of Providence. Bulkhead Rock was removed, and an anchorage area 1,060 feet wide with depths varying from 6 to 20 feet dredged between Fields Point and Fox Point; but both the channel and anchorage area had shoaled considerably in places and needed some redredging.

Under date of November 16, 1898, a continuous contract was entered into with Messrs. Perkins & O'Brien, of New York, for the extension of the new channel below Conanicut light-house, by the "Western Passage," requiring the removal of about 2,036,401 cubic yards of material at 10.8 cents per cubic yard, work to be commenced March 1, 1899, and completed July 1, 1902. The work of dredging under this contract was commenced March 1, 1899, and 500,841 cubic yards were removed up to the beginning of the present fiscal year.

A report of survey of Providence Harbor with a view to its further improvement was submitted under date of November 11, 1899, and printed as House Doc. No. 108, Fifty-sixth Congress, first session; also at page 1308, Annual Report of Chief of Engineers for 1900.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$17,122.48.

At the beginning of the fiscal year work was suspended for repairs to machinery and was carried on for short periods at intervals up to January 1, 1901, when the contract was annulled. Up to this date 25,867 cubic yards had been dredged since the beginning of the fiscal year.

Under date of January 28, 1901, proposals were invited for completing the work of dredging the channel through the "Western Passage," and on March 23, 1901, a contract was entered into with the International Contracting Company, of Syracuse, N. Y., for the remainder of the work, at 16.4 cents per cubic yard, work to commence April 1, 1901, and to be completed by October 1, 1903.

The work under the new contract was commenced April 1, and up to the close of the fiscal year 154,186 cubic yards of sand had been removed from the channel, making a total during the fiscal year of 180,053 cubic yards.

Four dredges are engaged upon the work.

This work was under the local charge of Mr. Edward Parrish as assistant engineer, with Messrs. C. O. Abell, Harwood E. Read, jr., Charles I. Comfort, Philip S. Knauer, W. D. Murray, Wm. J. Champion, jr., and C. C. Thurston, as inspectors.

An examination of the work done during the season of 1899 in the upper portion of the reach below Warwick Neck discloses the fact that there is a decided tendency to shoal in this portion of the channel. The material of the bottom is almost exclusively compact sand, the cutting is from 7 to 8 feet deep, and the ebb-tide current very strong and somewhat across the channel. These conditions render the maintenance of the full depth of the channel at least doubtful without considerable redredging for perhaps several years after the completion of work.

Operations contemplated during the fiscal year ending June 30, 1902.—It is proposed to continue the work of dredging in the new ship channel through the "Western Passage."

At the time of letting the contract to the present contractors a balance of 1,510,000 cubic yards remained to be dredged to complete the project. The price per yard (16.4 cents) of the new work is 5.6 cents greater than that of the old contract, so that the cost of completion will be increased by \$84,560 over the estimated cost of completion under the old contract, which will make the total cost of the present project \$424,049, which is well within the original estimated cost of \$732,820.

Providence River is in the collection district of Providence, which is a port of entry. The amount of revenue collected at Providence in the last calendar year was \$324,121.06. The nearest light-houses are the six light-houses in Providence River. The nearest fortifications are Fort Greble, on Dutch Island, and Fort Adams, R. I.

Money statement.

July 1, 1900, balance unexpended	\$138, 108. 60
Amount appropriated by sundry civil act approved March 3, 1901	59, 000. 00
	197, 108. 60
June 30, 1901, amount expended during fiscal year	17, 122. 48
	July 1, 1901, balance unexpended
July 1, 1901, outstanding liabilities	179, 986. 12
	17, 972. 26
July 1, 1901, balance available	162, 013. 86
July 1, 1901, amount covered by uncompleted contracts	222, 337. 57
{ Amount (estimated) required for completion of existing project	84, 560. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	84, 560. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

August 30, 1852	\$5, 000. 00	September 19, 1890	\$50, 000. 00
August 30, 1852, survey	1, 500. 00	July 13, 1892	50, 000. 00
May 2, 1867	25, 000. 00	August 18, 1894	17, 500. 00
July 11, 1870	5, 000. 00	June 3, 1896	25, 000. 00
July 15, 1870	2, 500. 00	June 4, 1897	125, 000. 00
June 10, 1872	10, 000. 00	July 1, 1898	125, 000. 00
March 3, 1873	10, 000. 00	March 3, 1899	10, 000. 00
March 18, 1878	5, 000. 00	June 6, 1900	54, 489. 00
June 18, 1878	50, 000. 00	March 3, 1901	59, 000. 00
March 3, 1879	60, 000. 00		
July 14, 1880	60, 000. 00	Total	1, 089, 989. 00
March 3, 1881	60, 000. 00	Received from sale of material	143. 39
August 2, 1882	125, 000. 00		
July 5, 1884	85, 000. 00	Total	1, 090, 132. 39
August 5, 1886	30, 000. 00		
August 11, 1888	40, 000. 00		

Contracts in force.

Contractor.	Date of approval.	To commence.	To complete.
Perkins & O'Brien.....	Dec. 13, 1898	Mar. 1, 1899	July 1, 1902 <i>a</i>
International Contracting Co.....	Mar. 27, 1901	Apr. 1, 1901	Oct. 1, 1903

a Contract annuled December 31, 1900.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Providence River, Rhode Island, by water during the calendar years ending December 31, 1895-1897 and 1899-1900, is estimated as follows (based mainly upon reports received from Mr. J. T. F. Bucklin, harbor master, and other citizens of Providence, R. I.):

Class of goods.	1895.	1896.	1897.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Grain and forage.....	20,079	19,509	20,000		
Lumber and products.....	47,503	46,500	64,989	57,208	47,349
Coal, minerals, etc.....	1,288,301	1,108,975	1,407,536	2,113,352	1,925,979
Oil, naphtha, etc.....			41,110	33,748	35,647
Fertilizers.....	386	375	583		
General merchandise.....	373,694	375,600	559,000	615,000	
Sundries.....	23,063	50,000	59,757		
Brick.....					7,607
Total.....	1,753,006	1,600,950	2,162,975	2,823,308	2,016,582

New transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steam:			
Freight and passenger.....	706	12	600
Freight, mainly.....	300	18	1,450
Passenger, mainly.....	3,500	7	518
Fishing.....	1,300	3	30
Tugs.....	1,500	13	100
Pleasure boats.....	1,500	5	30
Sail:			
Freight.....	850	18	1,500
Pleasure boats, large.....	400	7	40
Pleasure boats, small.....	1,500	3	7
Barges.....	1,650	16	1,200

D II.

IMPROVEMENT OF GREEN JACKET SHOAL, PROVIDENCE RIVER, RHODE ISLAND.

Green Jacket Shoal is in that part of Providence River which lies off the wharves on the south front of the city of Providence, and is an important part of the harbor for anchorage purposes.

Original condition.—That part of the harbor in which the shoal is located is about 2,000 feet long by from 600 to 1,200 feet wide; and of this area the shoal occupied about 30 acres, that part of it which was included between the 15-foot curves measuring about 18 acres. There were channels on either side of the shoal, between it and the State har-

bor lines, having at mean low water a width of 300 feet and a depth of 20 feet on the north side, and a width varying from 50 to 100 feet and a depth of about 15 feet on the south side. The water on the summit of the shoal was only 1 foot deep.

Plan of improvement.—The present approved project, that of 1885, provides for the removal to 25 feet depth at low water of a middle-ground shoal of about 30 acres area in Providence River opposite the city, no portion of the shoal within 200 feet of the harbor lines of the city to be removed by the General Government; all at a total cost estimated in 1885 at \$112,346.

A plan of the works may be found at page 598, Annual Report of the Chief of Engineers for 1885, and pages 830 and 832 of 1893.

Amount expended and results to June 30, 1900.—The total amount expended on the present project up to June 30, 1900, was \$103,917.74, by which 23.8 acres (out of the original 30) was dredged to 25 feet depth, and a 16-foot depth secured over the remaining central and largest portions of the shoal, making an important addition to the anchorage facilities of the harbor.

The report of a survey, with a view to the further improvement of Providence Harbor, was submitted November 11, 1899, and printed as House Doc. No. 108, Fifty-sixth Congress, first session, also at page 1308, Annual Report of Chief of Engineers for 1900.

Operations during the past fiscal year.—No funds were expended during the past fiscal year. No operations were in progress during the year, owing to the practical exhaustion of funds. Further work awaits further appropriations.

Work required to complete the existing project.—The work required to complete the existing project is the further deepening of the entire area to its full depth of 25 feet.

Operations contemplated for the fiscal year ending June 30, 1902.—Work on the project will be continued if funds are appropriated by Congress.

Green Jacket Shoal is in the collection district of Providence, which is a port of entry. The amount of revenue collected at Providence during the last calendar year was \$324,121.06. The nearest light-houses are the six light-houses in Providence River. The nearest fortifications are Fort Adams, R. I., and Fort Greble, on Dutch Island.

Money statement.

July 1, 1900, balance unexpended	\$332. 26
June 30, 1901, amount expended during fiscal year	117. 84
July 1, 1901, balance unexpended	214. 42
{ Amount (estimated) required for completion of existing project.....	8, 096. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	8, 096. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

Present project.

August 5, 1886.....	\$26, 250	August 18, 1894.....	\$7, 500
August 11, 1888.....	28, 000	June 3, 1896.....	7, 500
September 19, 1890.....	25, 000		
July 13, 1892.....	10, 000	Total	104, 250

For the commercial statistics see report of improvement of Providence River and Narragansett Bay, Rhode Island.

D 12.

IMPROVEMENT OF FALL RIVER HARBOR, MASSACHUSETTS.

Fall River Harbor lies at the mouth of Taunton River, in the north-eastern angle of Mount Hope Bay, which empties into the ocean through Narragansett Bay and Sakonnet River. It forms the port of entry of Fall River, the largest cotton manufacturing city in the United States, and its commerce is increasing yearly.

In 1900 Fall River had a population of about 105,000. The annual commerce of the port was estimated at 3,250,000 tons.

The mean rise and fall of the tide is about 4.7 feet.

Original condition.—Before improvement, the reentrant north of the Old Colony Steamboat Company's wharf was limited to about 6 feet depth at mean low tide, and a considerable area of the harbor, especially in front of the upper wharves, carried much less depth of water than existed in the approaches.

At the adoption of the present project the proposed channel had a minimum depth of about 14 feet at mean low tide.

Plan of improvement.—The project of 1897, approved by the river and harbor act of March 3, 1899, provides for a channel 300 feet wide and 25 feet deep at mean low tide along the city front between the Old Colony wharf and deep water at the upper end of the city front, at an estimated cost of \$58,060.47.

A description of the works may be found at page 727, Annual Report of the Chief of Engineers for 1895, and page 931 for 1897; also, the report of survey and map in House Doc. No. 56, Fifty-fifth Congress, first session.

Amount expended and results to June 30, 1900.—The total amount expended up to June 30, 1900, was \$49,997.40, of which \$30,000 was expended between 1874 and 1878 in deepening a channel way in the reentrant north of the Old Colony wharf 160 feet wide to 12 feet depth at mean low tide, with an additional width of 100 feet deepened to 11 feet, and \$19,997.40 was expended in dredging the lower reach of the new channel 300 feet wide and 25 feet deep along the city front.

A harbor line was established in this harbor and approved by the Secretary of War, January 12, 1900, a description of which will be found at page 1311, Annual Report of Chief of Engineers for 1900.

Operations during the past fiscal year.—No work was in progress during the past fiscal year.

Work required to complete the existing project.—The work required to complete the existing project is dredging the upper portion of the new channel above the Old Colony dock.

Operations contemplated for the fiscal year ending June 30, 1902.—It is proposed to continue the dredging of the proposed new channel as appropriations are made by Congress.

Fall River Harbor is in the collection district of Fall River, which is a port of entry. The amount of revenue collected at Fall River in the last calendar year was \$5,894.58. The nearest light-houses are Muscle Shoal, Bristol Ferry, and the light on the flats opposite the city. The nearest fortification is Fort Adams, R. I.

Money statement.

July 1, 1900, balance unexpended	\$2. 60
June 30, 1901, amount expended during fiscal year	2. 60
{ Amount (estimated) required for completion of existing project	38, 060. 47
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	38, 060. 47
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

Previous projects.

June 23, 1874	\$10, 000
March 3, 1875	10, 000
August 14, 1876	10, 000
Total	30, 000

Existing project.

March 3, 1899	\$20, 000
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COMMERCIAL STATISTICS.

The commerce arriving at and leaving Fall River Harbor, Massachusetts, by water during the calendar years ending December 31, 1898–1900, is estimated as follows (based upon reports received from Mr. James Brady, collector of customs, and other citizens of Fall River, Mass.):

Class of goods.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cotton and products	175, 000	175, 000	180, 000
Lumber and products	100, 000	100, 000	105, 000
Coal, minerals, etc	700, 000	715, 000	730, 000
General merchandise	2, 225, 000	2, 230, 000	2, 300, 000
Total	3, 200, 000	3, 220, 000	3, 315, 000

New transportation companies established during the year—none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	<i>Tons.</i>
Freight and passenger	750	12	2, 800
Freight mainly	500	10	1, 500
Passenger mainly	800	8	500
Tugs	425	7	85
Pleasure boats	370	7	100
Sail:			
Freight	420	10	175
Pleasure boats, large	315	6	11
Pleasure boats, small	1, 700	3	3
Barges	730	12	500

D 13.

IMPROVEMENT OF NEWPORT HARBOR, RHODE ISLAND.

Newport Harbor is at the main entrance to Narragansett Bay. This bay during the entire year offers an easily accessible harbor of refuge for our European and coastwise commerce quite equal in almost every respect to any harbor on this coast. Newport Harbor, lying at the eastern entrance to this bay and forming a part of it, has been used by vessels from very early times on account of its accessibility and well-sheltered location.

The objects of the improvement are to widen and deepen the entrance to the harbor and to enlarge its capacity for vessels seeking refuge in storms by increasing the area and depth of the anchorage within it. The mean rise and fall of the tide is about 3.75 feet.

Original condition.—Before improvement the capacity of the inner harbor was limited by shoals, and it was not sufficient for the vessels seeking it for refuge. The southern (main) entrance was obstructed by a bar which stretched out from Goat Island, and the northern entrance, near Rose Island, by a sharp rocky spit, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet.

At the adoption of the present project this harbor was limited to 12 feet depth at low water, and its anchorage area too small for the craft which seek harborage at this place during the summer and all the year during storms.

Plan of improvement.—The present approved project, that of 1880, as modified in 1882, 1883, 1884, 1890, and 1895, provides for the widening and deepening of the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at low water, with at least 750 feet width; for the extension of the 13-foot depth and 10-foot depth anchorage basins, and for dredging a channel 10 feet deep along the harbor line south from Commercial Wharf to a point opposite the gas company's wharf; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island, so as to protect the end of this island from erosion and to prevent the drift of sand, etc., around the island into the adjacent parts of the channel and harbor, and for the removal of Spindle Rock, a sharp rocky spit near Rose Island, all at a total cost estimated in 1895 at \$206,200.

A plan of the works may be found at page 604, Annual Report of the Chief of Engineers for 1885, and page 838 of 1893, and further details at page 562 of 1881, page 561 of 1882, page 494 of 1883, page 624 of 1884, page 736 of 1891, and page 627 of 1892.

Amount expended and results to June 30, 1900.—The amount expended to June 30, 1900, was \$195,318.63.

The project had been completed with the exception of the removal of a small area of hard pan and bowlders in the 13-foot anchorage area.

In July, 1897, a recommendation was submitted for a change in the harbor lines as established by the State in the harbor of Newport, R. I. The papers were returned to this office the same month with directions to arrange for a public hearing at Newport in regard to this matter, and said hearing was held on August 18, 1897, and report submitted

thereon on September 11, 1897. Under date of September 24 instructions were received to make a resurvey of the water front of Newport Harbor, and said survey has been made and map platted. By Department instructions of December 10, 1897, the subject of establishment of harbor lines at Newport Harbor was referred to The Board of Engineers constituted by Special Orders, No. 44, Headquarters Corps of Engineers, December 1, 1897, and directed that a public hearing be granted to all interested parties, and said hearing was held before said board on the 11th of January, 1898. Preliminary report was submitted on January 27, 1898.

The legislature of the State has from time to time authorized certain encroachments on the navigable area to individuals directly, as the waters of this locality are exempted from the jurisdiction of the State harbor board. In 1899 a wharf was built extending out into the harbor, based on a State act of four years previous, and in defiance of the United States acts bearing on the subject of navigable waters.

Operations during the past fiscal year.—No works of improvement have been in progress during the past fiscal year.

The wharf referred to above as encroaching upon the navigable waters of the harbor has been removed.

Work required to complete the existing project.—The work required to complete the existing project is the clearing up of shoal places in the harbor proper.

Operations contemplated for the fiscal year ending June 30, 1902.—Future operations are necessarily dependent upon Congressional action.

Newport is in the collection district of Newport and is a port of entry. The amount of revenue collected at Newport in the last calendar year was \$27,372.87. The nearest light-houses are Lime Rock and Newport (Goat Island) lights. The nearest fortification is Fort Adams, R. I.

Money statement.

July 1, 1900, balance unexpended	\$189.89
June 30, 1901, amount expended during fiscal year	189.89
{ Amount (estimated) required for completion of existing project	39,200.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	39,200.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

March 3, 1873	\$8,500.00	September 19, 1890	\$12,500.00
June 23, 1874	10,000.00	July 13, 1892	25,000.00
March 3, 1875	10,000.00	August 18, 1894	7,500.00
March 3, 1881	25,000.00	June 3, 1896	15,000.00
August 2, 1882	20,000.00	March 3, 1899	15,000.00
July 5, 1884	20,000.00	Received from sale of material	8.52
August 5, 1886	15,000.00		
August 11, 1888	12,000.00	Total	195,508.52

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Newport Harbor, Rhode Island, by water during the calendar years ending December 31, 1895–1900, is estimated as follows

(based mainly upon reports received from Mr. Martin H. Ball, deputy collector of customs, and other citizens of Newport, R. I.):

Class of goods.	1895.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cotton and products.....	175	150	150	160	150	140
Tobacco.....	25	30	40	50	50	50
Grains and forage.....	850	1,500	2,000	2,000	2,500	2,200
Vegetables and truck.....	10,535	12,000	13,000	12,000	12,000	12,500
Live stock and products.....	40,281	45,000	45,000	45,000	45,000	45,000
Fish, oysters, etc.....	136,644	138,000	150,000	150,000	150,000	155,000
Naval stores.....	1,239	1,200	1,300	1,300	1,300	1,300
Lumber and products.....	13,000	15,000	21,000	28,000	31,000	34,000
Coal, minerals, etc.....	50,000	75,000	73,000	80,000	82,000	84,500
Fertilizers.....	250	300	400	730	900	950
Machinery.....		200	1,000	1,000	1,500	1,500
General merchandise.....	121,152	125,000	127,500	125,000	135,000	140,000
Sundries.....		500	500	500	700	800
Total.....	374,151	413,880	434,900	446,230	462,100	497,940

New transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steam:			
Freight and passenger.....	1,450	12	2,050
Freight, mainly.....	420	10	1,200
Passenger, mainly.....	3,800	9	600
Fishing.....	650	9	200
Tugs.....	825	9	97
Pleasure boats.....	1,400	7	125
Sail:			
Freight.....	900	10	160
Fishing boats.....	900	6	30
Pleasure boats, large.....	1,825	6	15
Pleasure boats, small.....	3,000	3	4
Barges.....	350	12	650

D 14.

HARBOR OF REFUGE AT POINT JUDITH, RHODE ISLAND.

Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay.

At the adoption of the present project this point was a specially dangerous place for boats and tows to pass during storms and even ordinarily bad weather.

Plan of improvement.—The present approved project, that of 1889, provides for the construction of a national harbor of refuge nearly a mile square at this point by means of stone breakwaters, built partly on Squid ledge, and planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north; all at a total cost estimated in 1889 at \$1,250,000.

A description of the works may be found at page 595, Annual Report of the Chief of Engineers for 1890, and the general plan of the same in House Ex. Doc. No. 66, Fifty-first Congress, first session, and page 840 of 1893.

Amount expended and results up to June 30, 1900.—The total amount expended on the present project up to June 30, 1900, was \$1,243,626.95, by which the breakwater was built to a total length of 6,970 feet, a

height of 10 feet above mean low water; width on top, 20 feet; sea slope, 1 on 2 to a depth of 12 feet below low water, and thence to a slope of 1 on 1, and a harbor slope of 1 on 1. It incloses an area of about 1 square mile with 12 feet of water and about 0.92 of a mile with 18 feet of water, more than two-thirds of which is over 25 feet deep. Three beacon lights were established and maintained on the breakwater.

On September 9, 1896, a severe gale, accompanied by an unusually high tide, visited this locality and caused some damage to the top of the breakwater. In consequence of the damage thus sustained a board of engineers was convened to consider and report upon the subject of the construction of the harbor of refuge at Point Judith, R. I. The report of this board (see page 920, Annual Report of the Chief of Engineer for 1897) recommends the raising of the crest of the eastern arm of the breakwater to 9 feet above high water, the present height being 6 feet, and the postponement of the construction of the detached eastern breakwater until after the completion of the main work may demonstrate the necessity or otherwise of such a structure for additional shelter.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$1,523.73.

Three small lights were maintained on the breakwater during the year. During the year 16 steamers, 298 schooners, 97 sloops, and 2 barges took refuge behind the breakwater.

Work required to complete the existing project.—The work required to complete the existing project is the raising of the crest of the eastern arm of the breakwater to 9 feet above high water, the present height being 6 feet, and extension of the western arm 1,980 feet.

The completion of the project as recommended by the Board of Engineers involves the placing of 310,533 tons of stone in addition to the amount already placed, which it is estimated will cost \$444,311.

The eastern arm is completed, and the Board recommended that it be raised 3 feet; also that the western arm be extended to its projected length of 4,700 feet. This is regarded as necessary in order that the full results sought may be secured.

Operations contemplated for the fiscal year ending June 30, 1902.—The lights will be maintained. Future work depends on Congressional action.

Point Judith is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was \$27,372.87. The nearest light-house is Point Judith light. The nearest fortification is Fort Greble, on Dutch Island, Rhode Island.

Money statement.

July 1, 1900, balance unexpended	\$6,411.66
June 30, 1901, amount expended during fiscal year	1,523.73
July 1, 1901, balance unexpended	4,887.93
July 1, 1901, outstanding liabilities	125.00
July 1, 1901, balance available	4,762.93
{ Amount (estimated) required for completion of existing project	444,310.98
{ Amount that can be profitably expended in fiscal year ending June 30,	
1903, in addition to the balance unexpended July 1, 1901	444,310.98
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

AMOUNTS APPROPRIATED.

September 19, 1890	\$75,000.00	June 4, 1897.....	\$300,000.00
July 13, 1892.....	75,000.00		
March 3, 1893.....	100,000.00	Total.....	1,250,000.00
August 18, 1894.....	100,000.00	Received from sale of ma-	
March 2, 1895.....	300,000.00	terial.....	38.61
June 11, 1896.....	300,000.00		
		Total.....	1,250,038.61

COMMERCIAL STATISTICS.

The tonnage of vessels passing Point Judith, R. I., during the calendar years ending December 31, 1896-1898 and 1900, is estimated as follows (based mainly upon reports received from Mr. Asa Church, keeper Point Judith Life-Saving Station, Rhode Island, in gross tons:

Class of vessels.	1896.	1897.	1898.	1900.
Steamers (freight and fish).....	6,000,000	6,400,000	7,000,000	8,400,000
Yachts (steam and sail).....	700,000	700,000	700,000	1,000,000
Schooners (2, 3, and 4 masts).....	21,400,000	21,500,000	21,500,000	28,500,000
Ships, barks, and barkentines.....	180,000	180,000	180,000	180,000
Brigs and brigantines.....	60,000	60,000	60,000	60,000
Sloops.....	40,000	40,000	40,000	48,000
Barges.....	500,000	5,100,000	5,200,000	6,300,000
Total.....	33,380,000	33,980,000	34,680,000	44,488,000

D 15.

IMPROVEMENT OF ENTRANCE TO POINT JUDITH POND, RHODE ISLAND.

Point Judith Pond is a shallow salt pond lying in rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is the reopening of an old entrance long ago closed by the ocean storms.

The present entrance to this pond is very shallow (less than 3 feet), crooked, variable in location, and lies about a mile to the westward of the former entrance (now closed), where the improvement is desired.

Plan of improvement.—There is at present no approved project for this work, it having been reported as not worthy of improvement in 1873 by General Warren (pp. 286-289, Part II, Annual Report of the Chief of Engineers for 1874, and House Ex. Doc. No. 84, Forty-third Congress, first session), and also in 1888 by Major Livermore (pp. 642-643, annual report for 1889), and also in 1893 by Captain Bixby (see pp. 841 and 879, annual report for 1893). The appropriation for 1894 orders that all money so far appropriated shall be used in improving the former entrance to said pond.

Amount expended and results to June 30, 1900.—The total amount expended on this work up to June 30, 1900, was \$518.38 for a survey of the locality. A report of this survey, with estimate and project, was submitted July 2, 1895, and printed at page 689, Annual Report of the Chief of Engineers for 1895, and by direction of the Secretary

of War further action was delayed until the subject can again be considered by Congress. No field work has yet been done except in the way of examination and survey.

Operations during the past fiscal year.—No work done and no funds expended during the past fiscal year.

Operations contemplated for the fiscal year ending June 30, 1902.—No work contemplated for the fiscal year ending June 30, 1902.

Point Judith Pond is in the collection district of Newport, which is a port of entry. The amount of revenue collected at Newport in the last calendar year was \$27,372.89. The nearest light-house is Point Judith light. The nearest fortification is Fort Greble, on Dutch Island, Rhode Island.

Money statement.

July 1, 1900, balance unexpended	\$9,481.62
July 1, 1901, balance unexpended	9,481.62

AMOUNTS APPROPRIATED.

July 13, 1892.....	\$7,500
August 18, 1894.....	2,500
Total	10,000

For the commercial statistics, see Harbor of refuge at Point Judith, R. I.

D 16.

HARBOR OF REFUGE AT BLOCK ISLAND, RHODE ISLAND.

This island is a part of the State of Rhode Island; is 14 miles east of Montauk Point, the eastern end of Long Island, and is about 10 miles from the nearest point of the mainland. Besides supplying the wants of the mackerel-fishing fleet and the general coast navigation, the island is an important point of our shores for ocean navigation. It has a signal station connected by submarine telegraph with the mainland. Vessels are passing the island at all times and on all sides of it, and its position renders it of national importance. The object of the improvement is to furnish a harbor of refuge for medium draft vessels engaged in foreign and coastwise commerce. The mean rise and fall of the tide is about 3 feet.

Original condition.—Before the construction of the present harbor of refuge Block Island had no harbor which afforded protection for decked vessels. The only vessels used were open boats, which on the approach of storms were hauled up on the beach by oxen. The largest of these boats was of about 10 tons burden.

Plans of improvement.—Between 1870 and 1876, \$285,000 was appropriated to build a breakwater for a harbor for medium draft vessels. This work, including an inner harbor of 7 feet depth for temporary

use of the Government plant, was completed in 1878. (See p. 202 of annual report for 1877 and p. 313 of 1879.)

In 1880, \$6,000 was appropriated for dredging the inner basin to 9 feet depth. This work was completed in 1881. (See p. 390 of annual report for 1880 and p. 563 of 1881.)

In 1882, \$19,000 was appropriated for building a sea wall on the east side of the inner basin and protecting the cliffs on the east side of breakwater. (See p. 563 of annual report for 1882.) This work was completed in 1884.

In 1884, \$15,000 was appropriated for additions to the old breakwater. (See p. 628 of annual report of 1884.) These additions were made in 1884-85, partially closing a gap in this old breakwater.

The project of 1884, as modified in 1888, provided for the construction of a harbor of refuge on the eastern side of the island, consisting an enlarged inner harbor (or basin) for small vessels and an exterior harbor for large ones. The basin was to be about 800 feet square and completely inclosed except at its 100-foot-wide entrance. The exterior harbor was already formed by an old breakwater on the east and the adjacent shore on the south and west, but an old gap near the end of this breakwater was to be filled up. The project covered the construction of the stone sea walls of the enlarged inner harbor (\$46,000), the repair of the old breakwater (\$24,000), and a little dredging (\$5,000) along the western side of the old breakwater and also inside the harbor; all at a total cost estimated in 1888 at \$75,000. This project was practically completed in 1893.

The existing project, that of 1895, based on the report of the survey ordered in the river and harbor act of August 18, 1894, provides for raising the entire breakwater to proper height, stopping sand leaks between certain points, and dredging the main inner harbor to a depth of 10 feet, at an estimated cost of \$83,985.

A plan of the works may be found on page 612, Annual Report of the Chief of Engineers for 1885, page 844 of 1893, and in House Doc. No. 83, Fifty-fourth Congress, first session; and on page 674 Annual Report of the Chief of Engineers, 1896.

Amount expended and results up to June 30, 1900.—The total amount expended up to June 30, 1900, was \$412,576.11, by which the gap in the old breakwater was filled up so as to make the breakwater of 1,900 feet total length; the sea walls of the inner harbor were completed, except stone fender piers at the entrance, wooden fender piers being built for present uses. The north wall of the enlarged inner harbor had been strengthened and repaired.

About \$14,000 of the above amount were expended in maintaining the entrance channel to the harbor and in strengthening and repairing the north wall of the harbor.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$2,654.97.

No work of improvement was in progress during the fiscal year. Lights were maintained at the entrance to the harbor during the year.

Under present conditions the entrance to the harbor is liable to shoal up each year by reason of sand carried through the main breakwater during easterly storms. This will continue until the breakwater is made sand tight, as provided for in project of 1895; but in order to

carry this work on properly and economically, sufficient money will be required to complete this part of the project in one season. Otherwise, unless the necessary funds are provided for maintaining the channel at the entrance by dredging it out each year, at a cost of about \$2,500, it will close up and the inner harbor become practically useless except for boats of a very light draft. Under present conditions the annual cost of maintaining a channel into the inner harbor is estimated at \$2,500 for dredging. The cost of the necessary repairs to the main breakwater is included in the estimate for the existing project.

Work required to complete the existing project.—The work required to complete the existing project is to repair the main breakwater and stop sand leaks through certain portions of it, to repair and strengthen the west breakwater of the enlarged inner harbor, to dredge the enlarged inner harbor to a depth of 10 feet at mean low water, and to remove the crib work of the small inner harbor originally built to protect Government plant.

Operations contemplated for the fiscal year ending June 30, 1902.—Future operations will depend upon appropriations made by Congress.

Block Island is in the Newport collection district, and Newport is the nearest port of entry. The revenue collected at Newport during the last calendar year was \$27,372.87. There is no duty collected at Block Island. The value of the harbor is mainly as a harbor of refuge. There are several lights on the island. The nearest fortification is Fort Greble, R. I.

Money statement.

July 1, 1900, balance unexpended	\$3, 923. 89
June 30, 1901, amount expended during fiscal year	2, 654. 97
July 1, 1901, balance unexpended	1, 268. 92
July 1, 1901, outstanding liabilities	30. 00
July 1, 1901, balance available	1, 238. 92
{ Amount (estimated) required for completion of existing project	78, 985. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	78, 985. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

July 11, 1870	\$30, 000	August 5, 1886	\$20, 000
March 3, 1871	75, 000	August 11, 1888	15, 000
June 10, 1872	50, 000	September 19, 1890	15, 000
March 3, 1873	50, 000	July 13, 1892	24, 000
June 23, 1874	20, 000	August 18, 1894	2, 500
March 3, 1875	20, 000	June 3, 1896	5, 000
August 14, 1876	40, 000	March 3, 1899	10, 000
July 14, 1880	6, 000		
August 2, 1882	19, 000	Total	416, 500
July 4, 1884	15, 000		

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Block Island by water during the calendar years ending December 31, 1895-1900, is estimated as follows (based mainly upon reports received from local parties):

Class of goods.	1895.	1896.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cotton and products.....		10	10	10	12	15
Tobacco.....	30	30	32	32	30	36
Rice.....	10	12	12	13	12	13
Grains and forage.....	1,130	1,250	1,300	2,300	2,400	3,000
Vegetables and truck.....	515	650	650	700	800	800
Live stock and products.....	2,100	2,500	2,600	2,700	2,800	3,100
Fish, oysters, etc.....	10,050	15,000	15,000	14,000	14,500	19,000
Naval stores.....	5	10	10	10	10	17
Lumber and products.....	7,000	6,500	6,500	6,500	7,000	7,500
Coal, minerals, etc.....	8,650	15,000	15,000	14,000	14,500	15,000
Fertilizers.....	150	200	300	350	375	600
Machinery.....		100	100	100	125	200
General merchandise.....	6,625	6,600	6,700	6,700	6,700	6,800
Sundries.....	8,870	2,500	3,500	4,000	4,200	6,500
Total.....	45,135	50,362	51,714	52,915	55,064	63,281

New transportation companies established during the year, none reported.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steam:			
Freight and passengers.....	800	7-5	500
Freight mainly.....	70	8	275
Passenger mainly.....	150	7-5	350
Fishing.....	800	9	175
Tugs.....	400	8	150
Pleasure boats.....	1,500	8-5	150
Sail:			
Freight.....	500	9	150
Fishing boats.....	7,000	8	40
Oyster boats.....	200	7	30
Pleasure boats, large.....	1,300	8	15
Pleasure boats, small.....	7,000	5-5	7
Barges.....	40	10	350

D 17.

IMPROVEMENT OF GREAT SALT POND, BLOCK ISLAND, RHODE ISLAND.

Block Island is about 12 miles south of Point Judith and 15 miles northeast of Montauk Point; it is about 5 miles long, with an average width of 2 miles; has a population of 1,300; and the valuation of ratable property, as returned by the board of assessors for 1901, was as follows: Real estate, \$714,600; personal estate, \$166,200; total, \$880,900. About midway of the island north and south is a salt-water pond, known as the Great Salt Pond. Its water surface covers 700 acres, about 150 acres of which has a depth of 18 feet and over.

Plan of improvement.—The plan of improvement authorized by act of Congress June 3, 1896, provides for an entrance channel through the sand strip separating the pond from the ocean, with a least central depth of 25 feet, with a width of 150 feet, thence shoaling to 12 feet in a width of 504 feet, and thence to high-water line with a slope of 1 on 4; the total width at low water to be 600 feet. This channel was to

be protected by stone jetties, one on the south extending from the shore to the 18-foot contour and the one on the north to the 12-foot contour, all at an estimated cost in 1895 of \$97,567.94. This project was modified in 1900 so as to provide for extending the south jetty out 350 feet and the north jetty 600 feet farther than at first proposed, and to provide a revetment for the banks of the channel where it passed through the original beach, at an estimated cost for the entire work of \$305,000. For further information see Part 1, Annual Report of the Chief of Engineers for 1896, page 620, and same for 1900, page 1276.

The report of the survey, with map, upon which this project was based, was published as House Doc. No. 57, Fifty-fourth Congress, first session.

Amount expended and results up to June 30, 1900.—The total amount expended on this project by the Government up to June 30, 1900, was \$51,112.01, by which 26,901 tons of stone had been used in the construction and 706 tons in the repair of the south jetty, extending the same to the 18-foot contour, 1,262 feet from shore, and in dredging 90,519 cubic yards of sand, clay, and cobblestones, and 69.1 cubic yards of bowlders in excess of 1 cubic yard each, from the channel leading from the pond to the ocean, making a clear entrance to the pond 175 feet wide and 18 feet deep at mean low water, and 220 feet wide with a depth of 12 feet at the same stage of the tide.

Operations during the past fiscal year.—The amount expended during the past fiscal year was \$33,634.75.

At the beginning of the fiscal year work was in progress under the contract for dredging a channel 300 feet wide and 18 feet deep from the pond to the ocean; this contract was completed September 11, 1900, and the proposed channel completed. There were removed during the fiscal year 52,447 cubic yards of sand, clay, and cobblestones, and 76.2 cubic yards of bowlders in excess of 1 cubic yard each, making a total of 132,210 cubic yards of dredging and 145.3 cubic yards of large bowlders under the contract.

The contract for repairing the outer end of the south jetty, also in force at the beginning of the fiscal year, was completed in July, 907 tons of stone being placed, making a total of 1,613 tons under the contract.

A contract was entered into with John P. Randerson, of Albany, N. Y., under date of July 17, 1900, for dredging the central portion of the 18-foot channel to a depth of 25 feet at mean low water, at 29½ cents per cubic yard. Work under this contract was commenced September 12, 1900, and completed December 18, 1900; 43,786 cubic yards of sand, clay, and cobblestones, and 45.1 cubic yards of bowlders exceeding 1 cubic yard each were removed, completing one cut of about 30 feet in width and 25 feet in depth through the center of the channel.

Under date of May 23, 1901, the Chief of Engineers authorized the expenditure of the available balance, \$5,000, to strengthen and level up the outer end of the south jetty, which had been undermined by storms, so as to enable the Light-House Establishment to locate thereon a fog horn required by the needs of commerce. This work will be done under contract with Eugene S. Belden, Hartford, Conn., at \$1.23 per ton in place.

This work was in the local charge of Mr. Edward Parrish as assistant engineer, with Mr. Henry F. Hill as inspector.

Work required to complete the existing project.—The deepening and widening of the channel, the extension of the south jetty, and the construction of the north jetty 600 feet from the south jetty and parallel to it, as provided for in the approved project.

Operations contemplated for the fiscal year ending June 30, 1902.—It is proposed to apply the available funds to repairing the outer end of the south jetty.

Great Salt Pond is in the Newport collection district, and Newport is the nearest port of entry. The revenue collected at Newport during the last calendar year was \$27,372.87. There is no duty collected at this place. The value of the harbor is mainly as a harbor of refuge. There are several light-houses at the island. The nearest fortification is Fort Greble, R. I.

Money statement.

July 1, 1900, balance unexpended	\$38,887.99
June 30, 1901, amount expended during fiscal year	33,634.75
July 1, 1901, balance unexpended	5,253.24
{ Amount (estimated) required for completion of existing project	215,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	100,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

June 3, 1896	\$40,000
March 3, 1899	50,000
Total	90,000

Contract in force.

Contractor.	Date of approval.	To commence.	To complete.	Rate per ton of 2,000 pounds in place.
Estate of John Beattie (repairing jetty)	June 13, 1900	June 30, 1900	July 20, 1900	\$1.40

COMMERCIAL STATISTICS.

The commerce arriving at and leaving the Great Salt Pond, Block Island, Rhode Island, by water during the calendar years ending December 31, 1899–1900, is estimated as follows (based upon the most reliable information obtainable):

Class of goods.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>
Grains and forage	300	2,000
Fish, oysters, etc	1,000	2,500
Lumber and products	500	1,000
Coal, minerals, etc	2,000	1,500
General merchandise	300	5,000
Vegetables and truck		150
Fertilizers		200
Machinery		500
Sundries		500
Total	4,100	13,350

New transportation companies established during the year: One New Shoreham steamer, to run between Providence and Block Island, and to carry United States mail to Newport from Block Island.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	<i>Tons.</i>
Freight and passenger	1,000	10	600
Fishing.....	500	12	300
Tugs.....	500	10	100
Pleasure boats.....	5,000	3	5
Sail:			
Freight.....	500	10	100
Fishing boats.....	6,000	10	300
Pleasure boats, large ..	3,000	5	10
Pleasure boats, small ..	2,000	3	5
Barges.....	500	10	1,000

D 18.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of schooner Laura Robinson.—This wreck was reported in June, 1900, as lying sunk in about 40 feet depth of water at a point between the Shovelful and Pollock Rip light-ships in the main channel around the southern end of Cape Cod, and forming a dangerous obstruction to navigation.

Report and estimate of cost of removal were submitted July 7, and by Department indorsement of July 17 authority was received and allotment made for the removal of the wreck.

By August 29 the removal was completed by hired labor and use of a hired schooner, at a total cost of \$653.19.

Wreck of steamer Ardanhu.—The wreck of the British steamer *Ardanhu*, which was sunk by collision in Vineyard Sound, near Robinsons Hole, January 23, 1900, was reported to the Department September 13 as an obstruction to navigation, and by Department indorsement of September 17 authority was received and an allotment made for the removal of the wreck.

The work of removing the wreck was commenced October 12 with hired labor and the use of a hired schooner, and was completed December 18, 1900. About 3,100 pounds of dynamite were consumed in the work, the total cost of which was \$3,624.99.

Wreck of schooner David Siner.—This wreck was reported December 11, 1900, as forming a dangerous obstruction to navigation. The vessel was sunk in about 4 fathoms of water at a point about $1\frac{3}{4}$ miles WSW. from the Pollock Rip light-ship. By Department indorsement of December 26 authority was received and allotment made for its removal.

The work of removal was commenced January 3, 1901, by hired labor and the use of a hired schooner, and was completed February 7. The cost of the work was \$1,244.48.

Wreck of schooner Electa Bailey.—This vessel was stranded on Hardings Beach, Chatham, Mass., at the entrance to the channel leading into Stage Harbor, and was reported as an obstruction to navigation on May 9. By Department indorsement of May 13 authority was received and an allotment made for the removal of the wreck.

The wreck will be removed as soon as the diver can be spared from other work for that purpose.

D 19.

EXAMINATION AND SURVEY OF SAKONNET HARBOR, RHODE ISLAND.

[Printed in House Doc. No. 99, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 24, 1900.

SIR: I have the honor to submit herewith copies of reports dated July 11, 1900, by Maj. D. W. Lockwood, Corps of Engineers, and November 19, 1900, by Maj. George W. Goethals, Corps of Engineers, upon preliminary examination and survey, respectively, of Sakonnet Harbor, Rhode Island, to ascertain the advisability and cost of removing rocks which are an obstruction to navigation.

In the opinion of the local engineer, concurred in by the Division Engineer, Col. G. L. Gillespie, Corps of Engineers, the locality is worthy of improvement by the General Government to the extent of removing the rock nearest the steamboat wharf and a project for its removal to a depth of 8 feet below low water at an estimated cost of \$10,000 is presented.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF SAKONNET HARBOR, RHODE ISLAND, TO ASCERTAIN THE ADVISABILITY AND COST OF REMOVING ROCKS WHICH ARE AN OBSTRUCTION TO NAVIGATION.

UNITED STATES ENGINEER'S OFFICE,
Newport, R. I., July 11, 1900.

SIR: The preliminary examination of Sakonnet Harbor, Rhode Island, provided for in section 2 of the act of Congress approved June 6, 1900, making provision for emergencies in river and harbor works, for certain surveys, etc., having been assigned to me, I have the honor to submit the following report in reference thereto:

The wording of the act in reference to this locality is as follows:

Sakonnet Harbor: To ascertain the advisability and cost of removing rocks which are an obstruction to navigation.

There are three of these rocks in an east and west line due east from the end of the steamboat dock and distant from it. The first, about 100 feet; the second, 150 feet; and the third, 320 feet. The one nearest the dock is in the way of steamboats running to it, and its removal will be of great benefit to the steamboat interests. I have communicated with one of the leading fishermen of this section, who writes as follows:

You ask whether, in my opinion, it would be of any great advantage to fishermen to have the three rocks east of the steamboat pier at Sakonnet removed. In answer will say no, for the reason that ninety-nine in a hundred fishermen that make a harbor at the breakwater, lie south of the three rocks mentioned, and as they are near

the surface they break the sea to a certain extent from heavy winds that blow from north to north-northwest, with a clear and unobstructed rake of several miles.

If it is fishermen that you wish to protect, begin at the west rock and fill to the east rock as high or nearly as high as the breakwater built; in that case the fishermen that make their headquarters at that point will have a nice harbor.

The breakwater just finished is nice for the steamboat company, but of very little use to fishermen as a harbor protection, and if the three rocks are removed it will not be as good a harbor for them as it was before you began the improvement.

As the large rock nearest the wharf affords no more protection to the water area in rear of it than is now practically furnished by the breakwater, its removal, in my opinion, would not affect the harbor so far as small fishing vessels are concerned, and on that account I would recommend its removal. In my opinion, the harbor is worthy of improvement to the extent of removing this obstruction.

In order to properly estimate the cost of this work I would recommend that a survey be made covering the rock in question. The cost of this survey, in my opinion, will be \$250. There are no funds available from former appropriations for this survey.

Very respectfully, your obedient servant,

D. W. LOCKWOOD,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[Third indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, July 18, 1900.

Respectfully returned to the Chief of Engineers, concurring in the views of the district officer.

This improvement was visited by the division engineer on the 13th instant, and it was observed that the large rock at the entrance, awash at or near low water, was so close to the channel as to make it obstructive to the free navigation of the water area covered by the breakwater.

There seems to be no present need to remove the other rocks mentioned in the report.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer, Northeast Division.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 20, 1900.

Respectfully submitted to the Secretary of War.

This report relates to preliminary examination of Sakonnet Harbor, Rhode Island, authorized by the emergency river and harbor act approved June 6, 1900, "to ascertain the advisability and cost of removing rocks which are an obstruction to navigation."

The locality is reported to be worthy of improvement to the extent of removing one large rock nearest the steamboat wharf, and I recommend that a survey be made and the cost of the proposed improvement be estimated.

A. MACKENZIE,
Acting Chief of Engineers.

[Fifth indorsement.]

WAR DEPARTMENT,
*July 20, 1900.*Approved as recommended by the Acting Chief of Engineers.
By order of the Secretary of War:JOHN C. SCOFIELD,
*Chief Clerk.*SURVEY OF SAKONNET HARBOR, RHODE ISLAND, TO ASCERTAIN THE
ADVISABILITY AND COST OF REMOVING ROCKS WHICH ARE AN OBSTRU-
TION TO NAVIGATION.U. S. ENGINEER OFFICE,
Newport, R. I., November 19, 1900.

GENERAL: The act of Congress approved June 6, 1900, "making provision for emergencies in river and harbor works, for certain surveys," etc., requires a preliminary examination and survey of "Sakonnet Harbor, to ascertain the advisability and cost of removing rocks which are an obstruction to navigation." This work having been assigned to this office, the survey of the three rocks in the harbor has been made by Mr. Edward Parrish, assistant engineer, whose report is appended, and a tracing¹ of the map is herewith, showing the location of the rocks in question with respect to the boat landing and breakwater.

The interests involved are those of the steamboat lines connecting this section of the country with commercial centers, this being the only convenient means of communication, and those of the fishing parties. The rock nearest the landing is a very serious obstruction to the steamboat interests. One of the boats has already come to grief on it, and it is very difficult to avoid during high northerly winds on account of its proximity to the wharf and breakwater recently completed to shelter the landing. The statistics for 1899 show that the steamboats carried to and from Sakonnet Harbor during 1899 12,092 tons of miscellaneous freight.

The fishing interests do not find any of the rocks obstructions, but advocate filling the gaps between them so as to make another breakwater, thus giving additional protection to their craft. This, however, is not worthy of consideration, as the location of such a breakwater with respect to the existing one shown on the drawing clearly indicates. The area protected, with the depth of water in the area, would confine its use to very small craft, which can now lie under the present breakwater, and, finally, such a recourse would not relieve the steamboat interests of the danger now threatening them.

The cost of removal of the three rocks is estimated at \$21,769 and of the rock nearest the landing at \$10,000, based on the removal of the rocks to a depth of 8 feet below low water, allowing 1 foot for over-depth.

In view of the fact that the rock nearest the wharf is the only serious obstruction, that the removal of the other two would not make navigation easier or less dangerous, but would deprive the fishing

¹ Not printed.

interests of the protection they now afford, I have the honor to recommend that the work of improvement be confined to the removal of rock No. 1, the one nearest the wharf.

Very respectfully, your obedient servant,

GEO. W. GOETHALS,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. EDWARD PARRISH, ASSISTANT ENGINEER.

U. S. ENGINEER OFFICE,
Newport, R. I., November 15, 1900.

MAJOR: I have the honor to submit the following report and map of a survey of certain rocks forming obstructions in Sakonnet Harbor, Rhode Island, made in October, 1900, in accordance with your instructions.

The rocks are just to the eastward of the steamboat wharf and are probably projections of a ledge crossing the harbor and cropping out prominently on both its eastern and western shores. The general depth of the harbor decreases from about 8 feet at the rocks, toward the south, to the 3 feet curve in a distance of from 150 to 300 feet, and increases toward the north to 18 and 20 feet depth in a distance of about 300 feet. The material of the rocks, all of which are partly uncovered at low tide, is granite.

On the map the rocks are designated as Nos. 1, 2, and 3, No. 1 being nearest the wharf. Soundings were taken at frequent intervals radially and on the circumferences of circles of different diameters, measured directly from a fixed point on the rock, and located by two transits on shore, and at such other points as needed examination. These soundings are plotted on a scale of 20 feet to 1 inch.

The commercial statistics for this harbor show that the steamers entering the harbor have an average draft of 8 feet. I have accordingly estimated for the removal of the rocks to that depth.

The amount of rock excavation required to secure a depth of 8 feet over the site of the rocks, allowing for 1 foot over-depth, would be as follows: Rock No. 1, 855 cubic yards; No. 2, 711 cubic yards, and No. 3, 413 cubic yards.

Rock No. 1 is a danger to the steamboats landing or leaving the wharf in times of high winds, and about a year ago the steamer *Queen City*, one of the regular line running to Providence, was seriously damaged by getting on this rock. The breakwater, completed during the present year, affords good protection to the wharf, but the wharf and rocks are in such close proximity that there is but little room to handle a boat on leaving the wharf. There is no other site for the wharf in which it could secure the benefit of the breakwater protection. It would therefore be of great advantage to the handling of the commerce of the locality to remove rock No. 1.

With regard to the rocks affording protection to the small boats anchored to the south of them, at the time of high northerly winds, there is doubtless some protection afforded in this manner, but the area so protected is very small and the water only from 3 to 6 feet deep. Nothing larger than catboats would seek shelter there. The breakwater covers the area that is also protected by rock No. 1 so that there would practically be no loss of protection by the removal of the latter.

The steamboat interests are the chief interests at present in the locality, for they afford the only convenient means of communication with business centers for a considerable extent of country bordering on the ocean. The nearest railroad communication is about 13 miles distant.

Rocks Nos. 2 and 3 not being especially in the way of steamboats, their removal might be productive of greater harm than benefit.

Estimate.

Removing the three rocks to 8 feet at mean low water:

1,979 cubic yards rock excavation, at \$10.....	\$19,790
Contingencies, office expenses, etc., 10 per cent.....	1,979

21,769

Removing rock No. 1 to 8 feet at mean low water:

855 cubic yards rock excavation, at \$10.....	\$8,550
Contingencies and office expenses	1,450
	10,000

The contingent expenses of survey and measurement would be a higher percentage of the cost of excavation in the case of the single rock than in that of the three.

Very respectfully,

EDWARD PARRISH,
Assistant Engineer.

Maj. GEORGE W. GOETHALS,
Corps of Engineers, U. S. A.

D 20.

PRELIMINARY EXAMINATION, PAWTUCKET RIVER, RHODE ISLAND, WITH A VIEW TO SECURING A CHANNEL 200 FEET WIDE AND 18 FEET DEEP FROM THE MOUTH OF THE RIVER AT PROVIDENCE, TO THE LOWER WHARVES IN THE CITY OF PAWTUCKET.

[Printed in House Doc. No. 89, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 22, 1900.

SIR: I have the honor to submit herewith for transmission to Congress copy of report, dated July 5, 1900, by Maj. D. W. Lockwood, Corps of Engineers, giving the results of a preliminary examination authorized by the emergency river and harbor act approved June 6, 1900, of Pawtucket River, Rhode Island, "with a view to securing a channel two hundred feet wide and eighteen feet deep from the mouth of the river at Providence to the lower wharves in the city of Pawtucket."

Very respectfully, your obedient servant,

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF MAJ. D. W. LOCKWOOD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 5, 1900.

SIR: The preliminary examination of Pawtucket River, provided for in section 2 of "the act of Congress approved June 6, 1900, making provision for emergencies in river and harbor works, for certain surveys, etc.," having been assigned to me, I have the honor to submit the following report in reference thereto:

The wording of the act in reference to this river is as follows:

Pawtucket River: With a view to securing a channel two hundred feet wide and eighteen feet deep, from the mouth of the river at Providence to the lower wharves in the city of Pawtucket.

Under date of August 29, 1899, I had the honor to submit a report of a preliminary examination of this river, provided for in river and harbor act of March 3, 1899, in which I stated that "in my opinion the locality is worthy of improvement" and recommending a survey cov-

ering that part of the river from the Red Bridge to Tennile River and from Bucklins Island to the Pawtucket Bridge, the stretch between Tennile River and Bucklins Island having already been recently surveyed. The report of the survey was submitted under date of November 25, 1899. Both reports were published in Document No. 113, House of Representatives, Fifty-sixth Congress, first session.

In the report of survey the estimate of the cost of securing a channel 100 feet wide on the bottom and 16 feet deep at mean low water up to the rock cutting and a channel 50 feet wide and 16 feet deep through it was \$237,875. The railroad bridge at India Point is the worst existing obstruction to the navigation of Pawtucket River, by reason of its location and draw opening, and in my report above mentioned I stated "while deeper water would doubtless lessen freight charges somewhat, the real trouble, in my opinion, is at the railroad bridge. Under the circumstances, I do not feel justified in recommending an increase in the depth of the channel of Pawtucket River while the condition of affairs remains as at present at this bridge." The indorsement of Col. G. L. Gillespie, Corps of Engineers, division engineer, on this report was as follows:

NORTHEAST DIVISION ENGINEER OFFICE,
New York, November 29, 1899.

Respectfully forwarded to the Chief of Engineers, concurring in the views of the district officer relative to the railroad bridge at India Point. This bridge, which was built in 1867-68, is not only badly located as regards the navigation of the river, but its draw openings have such deficient widths that the structure is an unreasonable obstruction to navigation.

It is recommended that no further appropriation be made for the improvement of the river from the railroad bridge to the town of Pawtucket until the bridge is reconstructed to meet the demands of the commerce of the upper reach of the river.

The New York, New Haven and Hartford Railroad Company, under date of March 28, 1900, submitted to the Secretary of War for approval papers and plans for a new drawbridge over Seekonk River at Providence, R. I., to wit, the bridge at India Point.

Under date of April 23, 1900, the plans were returned to the railroad company by the Secretary of War, in order that new plans conforming to certain changes required might be submitted if the company so desired. Nothing further has been heard of the matter.

In view of existing conditions, in my opinion, the Pawtucket River is not at present worthy of improvement. The width of 200 feet, named in the act, is considered excessive in view of the requirements of the commerce of the locality and the general character of the stream. To obtain this width and the depth named, the depth of cutting would be from 6 to 16 feet, and as the proposed channel stops at the lower wharves but little benefit would be derived from it farther up. Above the lower wharves the work would be in rock and very expensive. When the railroad bridge has been properly reconstructed a channel such as estimated for in my report of November 25, 1899, would, in my opinion, meet the needs of the present and prospective commerce of the Pawtucket River.

Very respectfully, your obedient servant,

D. W. LOCKWOOD,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, July 6, 1900.

Respectfully forwarded to the Chief of Engineers.

The opinion expressed by this office by indorsement November 29, 1899, quoted herein, is reaffirmed. It seems probable that the railroad bridge at India Point will be so modified at an early day as to meet the commercial demands of the river. When the work is accomplished the river will be worthy of improvement to the town of Pawtucket, as the records show that since the navigable depth at low stage has been increased from 5 feet to 12 feet in a channel 100 feet wide "the city of Pawtucket and its commerce have largely increased."

The channel dimensions mentioned in the act of June 6, 1900, seem excessive, and are therefore not recommended.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
 U. S. ARMY,
October 25, 1900.

Respectfully submitted to the Secretary of War, concurring in the opinion of the local officer and of the division engineer, that improvement of the locality by the General Government in the manner indicated by the act authorizing the examination, is not advisable.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
October 27, 1900.

The views of the local officer and of the division engineer, as concurred in by the Chief of Engineers, are approved.

ELIHU ROOT,
Secretary of War.

D 21.

EXAMINATION AND SURVEY OF OHIO REEF (LEDGE), NARRAGANSETT BAY, RHODE ISLAND.

[Printed in House Doc. No. 217, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
 UNITED STATES ARMY,
Washington, December 13, 1900.

SIR: I have the honor to submit the accompanying copies of reports, dated July 5 and December 8, 1900, with map, the former by Maj. D. W. Lockwood, Corps of Engineers, upon preliminary examination, and the latter by Maj. George W. Goethals, Corps of Engineers, upon survey, required by the provisions of the emergency river and harbor act of June 6, 1900, of Ohio Reef (Ledge), located in the east passage of Narragansett Bay, Rhode Island, with a view to determining the

advisability of removing said reef as a dangerous obstruction to the navigation of said bay.

It is stated by Major Goethals that the available depth of water on the flats surrounding this ledge is 17 feet, and the estimates submitted by him are based on the removal of sufficient material to secure this depth over the area now occupied by the ledge, the material to be removed consisting of sand, gravel, cobblestones, and boulders, all at an estimated cost of \$307,200.

For the reasons given by Major Goethals, he recommends that the work of removal as contemplated in the act be not undertaken, but that an efficient fog signal be erected on these shoals in order that vessels may locate their positions during thick or foggy weather.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF OHIO REEF (LEDGE), LOCATED IN THE
EAST PASSAGE OF NARRAGANSETT BAY, RHODE ISLAND, WITH A
VIEW TO DETERMINING THE ADVISABILITY OF REMOVING SAID REEF
AS A DANGEROUS OBSTRUCTION TO NAVIGATION OF SAID BAY.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 5, 1900.

GENERAL: The preliminary examination of Ohio Reef, Narragansett Bay, Rhode Island, provided for in section 2 of the act of Congress approved June 6, 1900, making provision for emergencies in river and harbor works, for certain surveys, etc., having been assigned to me, I have the honor to submit the following report in reference thereto.

The wording of the act in reference to this locality is as follows:

Ohio Reef, located in the east passage of Narragansett Bay: With a view to determining the advisability of removing said reef as a dangerous obstruction to navigation of said bay.

Ohio Reef, or, as it is named on the charts, Ohio Ledge, is in the northern part of Narragansett Bay, $2\frac{3}{4}$ miles southeasterly from Conimicut light. Between it and north point, on Popasquash Neck, the 18-foot channel is seven-eighths of a mile wide, with a maximum depth of about 40 feet.

The minimum depth on the ledge is 8 feet, while to the north and west of it is an extensive flat with a general depth of 17 to 18 feet, although in some places the depths are slightly less. This reef or ledge is an obstruction to navigation in heavy fogs, when the buoys marking it can not be seen, but in clear weather it is but little in the way, owing to the wide channel to the east of it. Were it removed, vessels that could cross the flats to the north and west of it would find no obstruction in any weather between Conimicut light and the wide passage between the north end of Prudence Island and Popasquash Neck. In my opinion the locality is worthy of improvement, but in what manner and to what extent can only be determined by a survey to develop the full extent of the ledge of reef and the nature of the

material composing it. If the cost of removal should be found excessive, then it might be found necessary to erect a light-house or at least a fog signal.

I estimate that a proper survey of the ledge will cost \$600.

Very respectfully, your obedient servant.

D. W. LOCKWOOD,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, July 6, 1900.

Respectfully forwarded to the Chief of Engineers, concurring in the views of the district officer.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 20, 1900.

Respectfully submitted to the Secretary of War.

This report is in reference to preliminary examination of Ohio Reef, Narragansett Bay, Rhode Island, authorized by the emergency river and harbor act approved June 6, 1900.

The locality is reported to be worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated.

A. MACKENZIE,
Acting Chief of Engineers.

[Fifth indorsement.]

WAR DEPARTMENT,
July 20, 1900.

Approved as recommended by the Acting Chief of Engineers.
By order of the Secretary of War:

JOHN C. SCOTFIELD,
Chief Clerk.

SURVEY OF OHIO REEF (LEDGE), LOCATED IN THE EAST PASSAGE OF NARRAGANSETT BAY, RHODE ISLAND, WITH A VIEW TO DETERMINING THE ADVISABILITY OF REMOVING SAID REEF AS A DANGEROUS OBSTRUCTION TO THE NAVIGATION OF SAID BAY.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., December 8, 1900.

GENERAL: The act of June 6, 1900, "making provision for emergencies in river and harbor works, for certain surveys," etc., contains the following provision for a preliminary examination and survey of—

Ohio Reef, located in the east passage of Narragansett Bay: With a view to determining the advisability of removing said reef as a dangerous obstruction to the navigation of said bay.

The examination and survey of this reef having been assigned to this office, I have the honor to submit the following report:

Ohio Reef is near the upper end of the eastern passage of Narragansett Bay, a little to the eastward of a straight line drawn from Conimicut light to Prudence Island light and about 850 yards west of the 25-foot channel through this passage, as shown in the accompanying map of the survey, on which its location in Narragansett Bay is also indicated.

The shoal extends about 1,800 feet in a north-and-south direction between the 18-foot contours and is about 900 feet wide in the widest part. This area was closely covered with soundings, and 75 borings were made, as indicated on the drawing. In addition to the borings made to determine the character of the bottom, an examination was made by a diver. In this way it was determined that the rocky portions were composed of a compact mass of large and small bowlders. With a pointed bar the diver was able to get through this mass to a depth of about 2 feet, and at this depth the character of the material remained unchanged. The bottom is very similar to that in the strait at Woods Hole, and can be dredged out with a suitable plant.

A table of the results of the borings accompanies the map of the survey. While it is possible that ledge rock may be encountered below the bowlders, the character of the shore on Popasquash Neck, the north end of Prudence Island, and farther north on Nayat Point, would indicate that the shoal is of a drift formation and not of the ledge rock occurring at Warwick Neck and farther south on Prudence Island.

It is to be noted that the available depth of water on the surrounding flats is 17 feet, and the estimates are based on the removal of sufficient material to secure this depth over the area now occupied by the ledge, which requires the taking out of 166,625 cubic yards of material, of which 78,750 cubic yards are sand and gravel, the remainder cobblestones and bowlders closely packed together, varying in size from 6 inches in diameter to a cubic yard or more. The removal of the sand and gravel is estimated to cost 20 cents per yard; for the bowlders \$3 per yard is estimated, which makes the total sum required to secure 17 feet depth over all \$307,200.

The reef is clearly marked by buoys and by a red sector in the Conimicut light. In clear weather it is well marked; it is then no obstruction to navigating either through the eastern and natural passage or through the new western passage, now being cut to a depth of 25 feet with a width of 400 feet. During thick or foggy weather vessels deviating from the eastern passage might run on it, and therefore it would become a serious obstruction, but vessels would be able to locate their position at such times were the shoal marked by an efficient fog signal. The removal of the ledge to a depth of 17 feet would not be of any assistance to heavier draft vessels, and to them the flats surrounding the ledge would be as great an obstruction.

In view, therefore, of the cost giving comparatively so little benefit—none at all to the navigability of the main ship channel—I have the honor to recommend that no work of removal be undertaken, but that an efficient fog signal be erected on these shoals, as it can be an obstruction only during thick or foggy weather.

ESTIMATES.

78,750 cubic yards sand and gravel, at 20 cents per cubic yard	\$15,750.00
87,875 cubic yards cobblestones and bowlders, at \$3 per cubic yard	263,625.00
Contingencies	279,375.00
Total	307,200.00

Very respectfully, your obedient servant,

GEO. W. GOETHALS,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

APPENDIX E.

IMPROVEMENT OF RIVERS AND HARBORS IN CONNECTICUT, AND OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

REPORT OF MAJ. SMITH S. LEACH, CORPS OF ENGINEERS, OFFICER
IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH
OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Pawcatuck River, Rhode Island and Connecticut. | 9. Housatonic River, Connecticut. |
| 2. Stonington Harbor, Connecticut. | 10. Bridgeport Harbor, Connecticut. |
| 3. Mystic River, Connecticut. | 11. Saugatuck River and Westport Harbor, Connecticut. |
| 4. Thames River, Connecticut. | 12. Norwalk Harbor, Connecticut. |
| 5. Connecticut River below Hartford, Connecticut. | 13. Fivemile River Harbor, Connecticut. |
| 6. Harbor of refuge at Duck Island Harbor, Connecticut. | 14. Stamford Harbor, Connecticut. |
| 7. New Haven Harbor, Connecticut. | 15. Harbor at Cos Cob and Mianus River, Connecticut. |
| 8. Breakwaters at New Haven, Connecticut. | 16. Greenwich Harbor, Connecticut. |

EXAMINATION AND SURVEY.

17. Branford Harbor, Connecticut.

UNITED STATES ENGINEER OFFICE,
New London, Conn., July 19, 1901.

GENERAL: I have the honor to transmit herewith annual report
* * * upon the works of river and harbor improvements in my
charge for the fiscal year ending June 30, 1901.

Very respectfully, your obedient servant,

SMITH S. LEACH,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

E 1.

IMPROVEMENT OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

Project.—To dredge a channel of 10 feet depth at mean low water
from Stonington Harbor to Westerly, with a width of 200 feet from
Stonington, Conn., to Avondale, R. I., a distance of 4 miles; a width

of 100 feet from Avondale to the lower wharves of Westerly, a distance of 2.75 miles, and a width of 40 feet between the upper and lower wharves of Westerly, a distance of 0.5 mile, at a total estimated cost of \$200,361.60.

No work was done during the fiscal year, from lack of sufficient funds. No examination of the dredged channel has been made since the survey of 1895, when low-water depths of 8 feet in the river channel and 7 feet in the channel across Little Narragansett Bay were the least found. The former is now reported unimpaired, but the latter is reported to have shoaled to $6\frac{1}{2}$ feet.

The project requires for its completion dredging to extend the 10-foot channel down the river to its mouth, a distance of 3.5 miles, where present depths are 8 to 10 feet at mean low water, and dredging the channel 200 feet wide and 10 feet deep across the bay, where $7\frac{1}{2}$ feet had been secured at the close of the dredging in 1884. The distance across the bay is 2.5 miles, but the natural depths for the larger part of the distance are 8 to 10 feet at mean low water. The removal of those shoals in the bay channel which now show depths of but $6\frac{1}{2}$ to 8 feet at mean low water is most urgently needed.

Pawcatuck River is in the collection districts of Providence and Stonington, the dividing line passing through the river. Providence and Stonington are the nearest ports of entry. The nearest light-houses are the Stonington and Watch Hill lights. The nearest fortification is Fort Mansfield, R. I., which commands the mouth of the river.

Money statement.

July 1, 1900, balance unexpended	\$94. 16
June 30, 1901, amount expended during fiscal year	1. 38
July 1, 1901, balance unexpended	92. 78
{ Amount (estimated) required for completion of existing project	170, 361. 60
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	15, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

For Pawcatuck River, Rhode Island and Connecticut:	
March 3, 1871	\$10, 000. 00
June 10, 1872	10, 000. 00
March 3, 1873	10, 000. 00
June 23, 1874	10, 000. 00
March 3, 1875	10, 000. 00
August 5, 1886	12, 000. 00
August 11, 1888	10, 000. 00
September 19, 1890	16, 600. 00
July 13, 1892	3, 800. 00
August 18, 1894	6, 000. 00
June 3, 1896	15, 000. 00
March 3, 1899	15, 000. 00
Total	128, 400. 00
December 5, 1895, unexpended balance deposited to credit of the United States Treasurer	399. 99
Total	128, 000. 01

For Little Narragansett Bay, Rhode Island and Connecticut:

August 14, 1876	\$5,000.00
June 18, 1878	10,000.00
March 3, 1879	5,000.00
June 14, 1880	5,000.00
March 3, 1881	5,000.00
August 2, 1882	6,000.00
Total	\$36,000.00
Aggregate	164,000.01

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through courtesy of Messrs. Maxson & Co., Westerly, R. I.]

The commerce arriving at and leaving Pawcatuck River, Rhode Island and Connecticut, by water during the calendar year ending December 31, 1900, is reported as follows:

Class of goods.	Tons.	Estimated value.
Bricks	700	\$2,100.00
Grains	611	11,012.00
Fish, oysters, etc. (estimated)	100	6,000.00
Lumber	9,800	88,198.00
Coal, minerals, and products	31,050	124,200.00
Fertilizers	100	2,500.00
Iron	1,560	37,440.00
Sand, gravel, and mud	10,500	10,500.00
Stone	1,909	2,863.00
Sundries (estimated)	1,200	60,000.00
Total	57,530	344,813.00

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Fect.</i>	<i>Tons.</i>
Freight mainly	140	7½	200
Passenger mainly (estimated)	100	5½	80
Tugs	750	6	45
Sail:			
Freight	250	8	200
Fishing boats	1,300	3	9
Pleasure boats, large (estimated)	900	2½	6
Pleasure boats, small	850	2	3
Total	4,290		

The amount of freight reported above is 9,212 tons less than reported for 1899.

E 2.

HARBOR OF REFUGE AT STONINGTON, CONNECTICUT.

The project approved in 1880 provided for the building of an outer breakwater, about one-half mile long, extending from Bartletts Reef to the vicinity of the Middle Ground Shoal, or until sufficient protection was secured against southerly winds. Additions to the project in

1884 and 1896 provide for dredging a channel across Noyes Shoal and for building a dike around Stonington Point. The last extension of the breakwater was completed in 1894, and the work provided for by the above additions to the project has been completed since that date. The length of the breakwater was not definitely stated in the original project, but, according to the report of the Board of Engineers, who made the report on which the project was based, was to be determined by the engineer officer in charge whenever the completed structure should, in his judgment, be adequate for the protection of the harbor. The length of about 2,900 feet, which has existed since 1894, having satisfactorily performed this function for several years, the district officer recommended by letter, April 4, 1901, that the project be considered completed, and under date of June 8, 1901, this recommendation was approved by the Chief of Engineers. The light on the west end of the breakwater was maintained by the Engineer Department until June 30, 1901, when it was transferred to the Light-House Department.

Stonington Harbor is in the Stonington collection district and is a port of entry. The principal value of the harbor is as a harbor of refuge. The nearest lights are Stonington light and Latimer Reef light. The nearest fortification is Fort Mansfield, R. I., 2 miles southeast.

Money statement.

July 1, 1900, balance unexpended	\$573. 79
June 30, 1901, amount expended during fiscal year	573. 79

AMOUNTS APPROPRIATED.

March 2, 1827 (survey)	\$200. 00	August 2, 1882	\$25, 000. 00
May 23, 1828	20, 000. 00	July 5, 1884	10, 000. 00
April 23, 1830	16, 491. 67	August 5, 1886	20, 000. 00
June 27, 1834	262. 16	August 11, 1888	8, 000. 00
March 3, 1873	25, 000. 00	September 19, 1890	12, 500. 00
June 23, 1874	20, 000. 00	July 13, 1892	12, 500. 00
March 3, 1875	25, 000. 00	August 18, 1894	5, 000. 00
June 18, 1878	40, 000. 00	June 3, 1896	5, 000. 00
March 3, 1879	37, 500. 00		
July 14, 1880	25, 000. 00	Total	337, 453. 83
March 3, 1881	30, 000. 00		

E 3.

IMPROVEMENT OF MYSTIC RIVER, CONNECTICUT.

The project, adopted in 1890, was completed in 1900, a channel at least 100 feet wide and 15 feet deep having been secured throughout the river below the bridge at Mystic and the proposed reduction of the bends having been effected. The small balance on hand at the beginning of the present year having been expended, this work of improvement was dropped from the list after being finally reported upon in March, 1901.

Mystic River is in the New London collection district, of which New London is the port of entry. There is a light-house on Morgan Point, on the west side of the river, at its mouth. The nearest fortifications are Fort H. G. Wright and Fort Mansfield, each about 6 miles distant from the mouth of the river, the former to the southwest, the latter to the east.

Money statement.

July 1, 1900, balance unexpended.....	\$246. 85
June 30, 1901, amount expended during fiscal year.....	246. 85

Appropriations for the improvement of Mystic River, Connecticut, have been made as follows:

Application.	Date.	Amount.
Dredging above and just below railroad bridge and at the mouth of the river.	Sept. 19, 1890	\$10, 000
Dredging below railroad bridge.....	July 13, 1892	10, 000
Dredging opposite Noank.....	Aug. 17, 1894	3, 500
Dredging at the mouth of the river.....	June 3, 1896	3, 500
Rock removal and dredging at the lower bends.....	Mar. 3, 1899	9, 600
Total.....		36, 600

E 4.

IMPROVEMENT OF THAMES RIVER, CONNECTICUT.

Project.—To make and maintain by dredging and a system of training walls a channel 200 feet wide from New London to Norwich, 16 feet deep at mean low water up to Allyn Point (about 5 miles below Norwich), and thence to Norwich 14 feet deep; also to dredge Shaws Cove, New London Harbor, 12 feet deep between harbor lines over an area of about $7\frac{1}{2}$ acres, at a total estimated cost of \$457,600.

The balance of the appropriation of \$20,000 in act of March 3, 1899, remaining on hand after the annulment of the contract with Frank H. Brainard, was applied to completing the work on open market basis, and at the beginning of the fiscal year work was in progress under agreement with T. A. Scott for completing the programme for dredging in Shaws Cove. This work was completed July 19, 18,290 yards having been dredged. Under a second agreement T. A. Scott removed about 27 yards of ledge rock to 13 feet depth below the mean low-water plane in the northern part of the cove, completing the work July 30, at a cost of \$250.

For the purpose of completing the unfinished work at Norwich, an agreement was made October 25, 1900, with John P. Randerson to dredge the slip on the west side of the Central Dock, at 15 cents per yard. Work was begun January 29, 1901, and was completed March 30, 19,259 yards having been dredged, thus securing 12 feet depth at mean low water. All the work contemplated by the programme for the expenditure of the above-mentioned appropriation has been accomplished, after some delays due to the difficulty of hiring dredging outfits on reasonable terms to do the small amounts of dredging left unfinished at the annulment of Frank H. Brainard's contract. A summary of the results is 71,942 yards dredged at Norwich, 61,117 yards dredged and about 27 yards of ledge rock removed from Shaws Cove, New London. All the area included between harbor lines at Shaws Cove has now been dredged to 12 feet at mean low water, but shoaling to a depth of 10 feet has occurred in portions of the cove which were dredged several years ago, the soft material from the sides having partially filled the dredged channels during the years when no work was done.

Future work under the present project will be applied, first, to restoring project depths in the channel at Allyn Point, and above

where shoals have formed since the last dredging in September, 1897, and in Shaws Cove; then, to widening the channel wherever it has not yet been dredged to project width.

The Thames River is in the collection district of New London. The nearest light-house is at the mouth of the river, on the west shore. The nearest fortification is Fort H. G. Wright, 8 miles south southeast.

Money statement.

July 1, 1900, balance unexpended	\$5,994.43
June 30, 1901, amount expended during fiscal year	5,691.19
July 1, 1901, balance unexpended	303.24
{ Amount (estimated) required for completion of existing project	49,100.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$12,000.00
For maintenance of improvement	8,000.00
	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for improving Thames River, Connecticut, have been made as follows:

Application.	Date.	Amount.
For previous projects:		
Removal of obstructions placed during the war of 1812	Mar. 3, 1821	\$150
Survey	Mar. 2, 1829	150
Piers and dredging	July 4, 1836	10,000
Do	July 7, 1838	10,000
Do	Mar. 3, 1837	20,000
Total		40,300
For the present project:		
Dredging and survey	June 23, 1866	10,000
Dredging	Mar. 3, 1867	72,000
Do	Mar. 3, 1871	15,000
Do	June 10, 1872	10,000
Do	June 18, 1878	10,000
Do	Mar. 3, 1879	12,000
Do	June 14, 1880	22,500
Dredging and training walls	Mar. 3, 1881	30,000
Training walls	Aug. 2, 1882	35,000
Do	July 5, 1884	25,000
Training walls and dredging	Aug. 5, 1886	22,500
Repairs of training walls and dredging	Aug. 11, 1888	50,000
Dredging	Sept. 19, 1890	20,000
Do	July 13, 1892	30,000
Do	Aug. 18, 1894	12,500
Do	June 3, 1896	12,000
Do	Mar. 3, 1899	20,000
Total		408,500
Total amount appropriated since 1821		448,800

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through the courtesy of Thomas A. Thompson, collector of customs, New London, Conn.]

FOREIGN.

Value of imports	\$18,514.84
Revenue receipts, duties on imports	1,945.27
Foreign vessels:	
Entered	10
Cleared	10
Total	20

Domestic vessels:

Entered	6
Cleared	7
Total	13

Net tonnage of vessels owned at this port.

Kind of vessel.	Number.	Tons.
Steamers	46	13,984
Sailing vessels	85	14,138
Barges	23	5,316
Total	154	33,438

COMPILED FROM VARIOUS SOURCES.

COASTWISE.

Requests were sent out for statistics of the commerce of Thames River and New London Harbor for 1900, but the responses received gave incomplete data. The following tables have been compiled by comparing and combining such data as was received with the report of the previous year.

New London Harbor.

Kind of vessel.	Draft in feet.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	5 to 19	665	2,778,300
Sailing	6 to 21½	169	78,700
Barges	7½ to 20½	392	221,000
Total		1,226	3,078,000

FREIGHT RECEIVED AND SHIPPED BY WATER.

COASTWISE.

Chief articles.	Tons.	Estimated value.
Coal	251,000	\$857,000
Lumber	8,000	88,300
Oil and naphtha	7,330	160,520
Fish, etc	1,700	170,000
Building materials	4,700	17,000
General merchandise	477,660	59,146,000
Total	750,390	60,438,820

Thames River.

[Exclusive of New London Harbor.]

Kind of vessel.	Draft in feet.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	8	13	3,100
Sailing vessels	10 to 15½	243	80,311
Barges	7½ to 14	487	380,872
Total		743	464,283

FREIGHT RECEIVED AND SHIPPED BY WATER.

Chief articles.	Tons.	Estimated value.
Coal.....	450,000	\$1,912,500
Lumber.....	21,600	161,000
Iron pipe, sand, etc.....	2,500	100,000
Total.....	474,100	2,173,500

Passenger and freight steamers not covered by the above reports, engaged in traffic between New London and the following ports: One each to Long Island and Fishers Island, making one or more trips per day all the year; 1 to New York, making 3 trips per week all the year; 8 to Block Island, Watch Hill, Fishers Island, Mystic, Plum Island, Long Island, Norwich, and other points making one or more trips per day during the summer; ferry to Groton, making constant trips daily. These vessels draw from 5 to 10 feet of water and have an aggregate tonnage of about 2,000 tons; they carry an aggregate of about 370,000 passengers and 20,000 tons of miscellaneous freight.

No new lines of commercial steamers were established during the year 1900. The Colonial Line, which was established last year, discontinued the use of this port after one of its steamers had called here once. Beginning in July, 1900, the Quartermaster Department steamer *Captain Reilly* has made daily trips from this port to forts Michie, Terry, H. G. Wright, and Mansfield.

Two new shipyards have been under construction on the Thames River during the year, viz, The Eastern Shipbuilding Company, located on the east bank opposite New London, and the Thames Tow Boat Company Marine Railways, located on the west bank, about 2 miles higher up. The former had begun the building of two steel ships, each 630 feet long, 73 feet beam, drawing 33 feet loaded and 24 feet on trial. Should it be decided to bring all material for building purposes by water there would be required about seven vessels drawing 22 to 25 feet per year, based on the work in hand at present. The marine railways at the yard of the Thames Tow Boat Company, are designed to haul out vessels drawing 21 feet of water and 300 feet long on the keel.

E 5.

IMPROVEMENT OF CONNECTICUT RIVER BELOW HARTFORD, CONNECTICUT.

Project.—To enlarge the present jetties at the river's mouth and to dredge annually through the several bars in the river below Hartford as may be necessary to maintain channels 9 feet deep and 100 feet wide, except that the channel through Saybrook bar, at the river's mouth, is to be 12 feet deep and 400 feet wide. The estimated cost is \$130,000 for permanent work and \$10,000 per year for annual dredging.

Appropriations of late years have been \$20,000, the amount required for two years' dredging, and no progress has been made on the permanent works, nor has the jetty channel been fully developed. This channel, now about 130 feet wide and 9 feet deep, should be widened, though possibly not to the projected width of 400 feet, and deepened.

The jetties at the mouth of the river protecting the channel across the sea bar were never completed to projected cross section, and deterioration by settlement and wave attack has made them of still slighter character, so that in their present condition they not only lack strength for their own protection from serious injury, but perform their functions very imperfectly. As a result, the channel through the sea bar is much obstructed and urgently requires the application of funds for its restoration. As heretofore reported, at least 10,000 tons of riprap should be placed on the jetties, and some repairs should also be

made to Hartford dike. In the annual dredging operations of recent years a preponderance of work has been applied to removing the shoal which forms at Hartford dike, and it is believed that increasing the height of this dike, as heretofore recommended, would appreciably diminish the amount of annual maintenance expenditures. It is for these purposes that the sum estimated, in addition to the \$10,000 for annual maintenance, is introduced below, and to the necessity of some such provision attention is respectfully but earnestly invited.

At the beginning of the fiscal year the work of annual dredging was in progress under the contract made April 27, 1900, with the Hartford Dredging Company. Work under this contract was completed August 27, the total amount dredged being 64,284 yards. The quantities dredged at each of the several bars are as follows:

	Yards.
Hartford bars	20, 158
Clay Banks bar	9, 414
Pistol Point bar	7, 102
Dividend bar	2, 767
Press Barn bar	7, 103
Glastonbury bar (Two Piers)	3, 553
Potash channel	10, 915
Calves Island	3, 272

The dredging required in the spring of 1901 in order to maintain the channel in accordance with the adopted project could not be undertaken by the National Government for lack of sufficient funds. The freshets are reported to have been very extensive during this spring, and the Hartford and New York Transportation Company found it necessary to begin the usual dredging operations on June 3. They state that they expect to do about as much dredging as is usually done each year. The work is in charge of William C. Lynch, who was the inspector for the United States during the annual dredging work of 1900.

The Connecticut River is in the collection district of Hartford. There is a lighthouse on Saybrook Point, on the west shore of the river, at its mouth, and another at the end of the west jetty; besides which there are three small beacon lights and several range lights in the river which are maintained by the United States. Fort Terry, N. Y., is the nearest fortification, 11 miles southeast of Saybrook Point.

Money statement.

July 1, 1900, balance unexpended	\$9, 105. 56
June 30, 1901, amount expended during fiscal year	8, 779. 16
July 1, 1901, balance unexpended	326. 40
Amount (estimated) required for completion of existing project	110, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$10, 000. 00
For maintenance of improvement	20, 000. 00
	30, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for improving the Connecticut River below Hartford have been made as follows:

Application.	Date.	Amount.
Dredging at Saybrook bar	July 4, 1836	\$20,000.00
Dredging at Saybrook bar (the unexpended balance of 1836 reappropriated)	Mar. 3, 1839	.....
Balance due contractor under previous appropriation	Mar. 1, 1843	3,471.57
Dredging at Pratts Ferry, Pistol Point, Mouse Island; piling at Hartford..	July 11, 1870	20,000.00
Dredging at Hartford, Clay Banks, Pier 1, Pier J, Pratts Ferry, Glastonbury, Pistol Point, and Chester Rock	Mar. 3, 1871	35,000.00
Dredging at Pratts Ferry, Pistol Point, and Saybrook jetty	June 10, 1872	40,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, and Saybrook jetty	Mar. 3, 1873	20,000.00
Dredging at Hartford, Pratts Ferry, Saybrook, Saybrook jetties	June 23, 1874	20,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Saybrook jetties	Mar. 3, 1875	20,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Saybrook jetties, Salmon River dredging	Aug. 14, 1876	20,000.00
Compensation for previous dredging	 1878	4,203.00
Saybrook jetties, survey from Hartford to Rocky Hill	June 18, 1878	30,000.00
Dredging at Hartford, Press Barn, Glastonbury	Mar. 3, 1879	10,000.00
Dredging at Hartford, Glastonbury, and Saybrook jetties	June 14, 1880	10,000.00
Dredging at Hartford, Pratts Ferry, Glastonbury, Glastonbury wing dam, Saybrook jetties	Mar. 3, 1881	30,000.00
Dredging at Hartford, Clay Banks, Pratts Ferry, Press Barn, Glastonbury, Dividend, Pistol Point, and Salmon River, Hartford dike	Aug. 2, 1882	45,000.00
Dredging at Hartford, Clay Banks, Pratts Ferry, Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, and between Saybrook jetties, extending west jetty at Saybrook	July 5, 1884	35,000.00
Compensation for previous dredging	Mar. 3, 1885	4,745.43
Dredging at Hartford, Clay Banks, Naubuc, Press Barn, Glastonbury, Dividend, Pistol Point, and Haddam Island; repairs of Hartford dike and Saybrook jetties	Aug. 5, 1886	26,250.00
Annual dredging at Hartford, Clay Banks, Press Barn, Glastonbury, Dividend, Brockways	Aug. 12, 1888	10,000.00
Annual dredging at Hartford, Clay Banks, Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, Haddam Island	Sept. 19, 1890	12,500.00
Annual dredging at Hartford, Clay Banks, Naubuc, Press Barn, Glastonbury, Dividend, Pistol Point, Mouse Island, Sears Shoal, Chester Rock, Devils Reef, Calves Island	July 13, 1892	20,000.00
Annual dredging upon several bars below Hartford, in progress	Aug. 18, 1894	20,000.00
Do	June 3, 1896	20,000.00
Do	Mar. 3, 1899	20,000.00
Total		496,170.00

Contract in force for dredging in Connecticut River, Connecticut.

Name of contractor.	Date of contract.	Date of approval.	Work begun.	Contract completed.
Hartford Dredging Co	Apr. 27, 1900	June 4, 1900	June 5, 1900	Aug. 27, 1900

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

[Through courtesy of Mr. C. C. Goodrich, general manager of the Hartford and New York Transportation Company, who reports that the statistics for 1900 are the same as those reported for 1899.]

Arrivals and departures of vessels.

[Draft, 6 to 12 feet; tonnage, 100 to 1,600 tons.]

Kind of vessel.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	400	850,000
Sailing vessels	250	
Barges	750	
Total	1,400	850,000

Freight received and shipped by water.

Chief articles.	Tons.	Value.
Receipts:		
Coal.....	380,000	\$36,000,000
Stone.....	65,000	
Miscellaneous goods.....	25,000	
Shipments:		
Stone, estimated.....	75,000	\$11,000,000
Wood, lumber, etc.....	65,000	
Miscellaneous goods.....	90,000	
Total receipts and shipments.....	700,000	47,000,000

These figures show no increase in tonnage of freights over that reported for 1899.

No new line of transportation has been established during the year.

The above is a close estimate, much of it being based on weights and cubic measurements of freights carried by the company.

Government improvements are and have been of great importance in attaining these results. The usual dredging should be continued. The dike at Hartford should be increased to the height originally intended. The season of 1900 was the longest season of open navigation for many years. The care of the waterway by the United States Government has been excellent.

E 6.

IMPROVEMENT OF HARBOR OF REFUGE AT DUCK ISLAND,
CONNECTICUT.

Project.—To build three breakwaters, aggregating 5,880 feet in length, at an estimated cost of \$463,540.

The only work done on this improvement during the fiscal year consisted in repairing a breach made by the storm of December 4, 1900, near the western extremity of the breakwater, by placing 200 tons of riprap stones, each 3 to 10 tons in weight, on the crest and rear slope adjacent to the mound on which the lantern pole and oil house stand. The work was done by the steam lighter *Panuco*, belonging to the Engineer Department, at a total cost of \$202, which was paid out of an allotment of \$300 made for this purpose January 3, 1901, from the appropriation for emergencies in rivers and harbors in the act of June 6, 1900. This breakwater is now in good condition except that the portion built in 1898 has settled 4 or 5 feet and will need retopping when the next appropriation becomes available.

Duck Island is in the collection district of Hartford. The nearest light-house is at Saybrook Point, at the mouth of the Connecticut River, about 8 miles eastward. There is a light-vessel on Long Sand shoal, about 5 miles to the southeast. The nearest fortification is Fort Terry, N. Y., 16 miles southeast.

Money statement.

July 1, 1900, balance unexpended.....	\$93.60
July 1, 1901, balance unexpended.....	93.60

{ Amount (estimated) required for completion of existing project	349,540.00
{ Amount that can be profitably expended in fiscal year ending June 30,	
{ 1903, in addition to the balance unexpended July 1, 1901	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4,	
{ 1897.	

1170 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Appropriations for harbor of refuge at Duck Island Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Westerly breakwater:		
946 feet.....	Sept. 19, 1890	\$25,000
714 feet.....	July 13, 1892	35,000
725 feet and repairs.....	Aug. 17, 1894	30,000
885 feet and repairs.....	June 8, 1896	24,000
Repairs.....	June 6, 1900	202
Total.....		114,202

EMERGENCIES IN RIVER AND HARBOR WORKS (ACT OF JUNE 6, 1900), FOR "REPAIRING BREAKWATERS AT DUCK ISLAND HARBOR, CONNECTICUT."

January 3, 1901, amount allotted.....	\$300
June 30, 1901, amount expended during fiscal year.....	202
	98
April 22, 1901, amount deposited to credit of Treasury United States	98

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

No complete record of the number of vessels passing this harbor of refuge is kept. It is believed to be approximately two-thirds of the number passing the New Haven breakwater, which is reported as 151,356 for the year 1895.

The following record of vessels anchoring inside the breakwater during the year 1900 was furnished by the light keeper, and serves to show to what extent this harbor was actually used for refuge:

Schooners.....	700
Sloops.....	143
Towboats and barges.....	147
Steam canal boats, with consorts in tow.....	217
Steam oyster boats.....	15
Schooner yachts.....	109
Sloop yachts.....	264
Steam yachts.....	47
Catboats.....	65
Total.....	1,707

E 7.

IMPROVEMENT OF NEW HAVEN HARBOR, CONNECTICUT.

Project.—To dredge a channel 20 feet deep, 400 feet wide, and 4 miles long, from Long Island Sound to Canal dock; a channel 20 feet deep, 300 feet wide, and one-half mile long, from Canal dock to Tomlinson Bridge, and three anchorage basins of 20, 16, and 12 feet depths, respectively, estimated to require the removal of 3,287,000 yards, at a cost not to exceed \$345,000.

Work under the continuing contract, which was entered into July 31,

1899, with John T. Regan, was in progress at the beginning of the year, and was continued with but slight interruptions throughout the year. The total amount dredged was 653,766 yards, comprising 308,631 yards removed from the 20-foot anchorage basin and the main channel adjacent thereto, 107,336 yards removed from the main channel opposite the 16-foot anchorage basin, 177,477 yards removed from the main channel between the bend opposite Long wharf and Tomlinson Bridge, and 60,322 yards removed from the 12-foot anchorage basin.

The work of this year has been devoted to widening the 20-foot channel from Fort Hale bar to Tomlinson Bridge and to developing the 20-foot and 12-foot anchorage basins. The net results of the past two years' work are a channel 20 or more feet deep extending from Long Island Sound to Tomlinson Bridge, 200 feet in width up to the 20-foot anchorage basin, where the width increases to about 600 feet; 120 feet in width alongside the 16-foot anchorage basin for about one-half mile, where present depths outside the channel are 16 to 18 feet, and 215 feet in width along the docks to Tomlinson Bridge, with an increase to about 400 feet in width at the bend opposite Long wharf; in addition to which the 12-foot anchorage basin has been dredged over about one-third its area. Work under the first appropriation was not finished until September 24, 1900, thus exceeding the time allowed under the terms of the contract (see p. 1333, Annual Report, 1900) for earning this appropriation at the higher contract price of 6 cents per yard; consequently 21,440 yards were paid for at the lower contract rate of 3 cents per yard. Under the second appropriation (\$50,000 in act of June 6, 1900), which has been applied to all work done since September 24, 1900, 617,350 yards have been dredged at the rate of 6 cents per yard. This rate continues until July 26, 1901, one year from the date on which the contractor was notified that this appropriation was available. Any portion of it remaining unearned at that time must be earned later at 3 cents per yard before any subsequent appropriation can be drawn upon. The third appropriation (\$50,000 in act of March 3, 1901) will be applied to developing the anchorage basins and to widening the main channel to nearly or quite full width from Fort Hale bar to Tomlinson Bridge, in accordance with the programme approved March 27, 1901.

Money statement.

July 1, 1900, balance unexpended	\$75,966.49
Amount appropriated by sundry civil act approved March 3, 1901	50,000.00
	125,966.49
June 30, 1901, amount expended during fiscal year	43,709.29
July 1, 1901, balance unexpended	82,257.20
July 1, 1901, outstanding liabilities	9,971.20
July 1, 1901, balance available	72,286.00
July 1, 1901, amount covered by uncompleted contracts	129,535.80
{ Amount (estimated) required for completion of existing project	66,656.80
{ Amount that can be profitably expended in fiscal year ending June 30,	
1903, in addition to the balance unexpended July 1, 1901	66,656.80
{ Submitted in compliance with requirements of sundry civil act of June 4,	
1897.	

1172 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Appropriations for the improvement of New Haven Harbor have been made as follows:

Application.	Date.	Amount.
Removal of Middle Rock, not expended until 1867.....	Aug. 30, 1852	\$6,000
Removal of rocks.....	July 11, 1870	15,000
Dredging (13 feet) above Fort Hale.....	Mar. 3, 1871	40,000
Dredging (16 feet) Fort Hale bar and removal of rocks.....	June 10, 1872	35,000
Dredging (16 feet) Fort Hale bar.....	Mar. 3, 1873	25,000
Dredging (13 feet) above Long wharf.....	Mar. 3, 1875	10,000
Dredging (16 feet) Long wharf to Fort Hale.....	June 18, 1878	25,000
Dredging (16 feet) above Long wharf.....	Mar. 3, 1879	15,000
Do.....	June 14, 1880	15,000
Dredging (16 feet) Long wharf to Fort Hale.....	Mar. 3, 1881	15,000
Sandy Point dike.....	Aug. 2, 1882	30,000
Dredging (18, 12, and 8 feet) above Long wharf.....	July 5, 1884	10,000
Sandy Point dike.....	Aug. 5, 1886	20,000
Do.....	Aug. 11, 1888	15,000
Dredging.....	Sept. 19, 1890	15,000
Do.....	July 13, 1892	15,000
Dredging (Fort Hale bar).....	Aug. 18, 1894	10,000
Resurvey and dredging.....	June 3, 1896	10,000
Dredging (20 feet) main channel, Long Island Sound to Long wharf.....	Mar. 3, 1899	50,000
Dredging (20 feet) main channel and anchorage basins.....	June 6, 1900	50,000
Do.....	Mar. 3, 1901	50,000
Total.....		476,000

All appropriations except the last three were applied to previous projects.

Contract in force June 30, 1901, for dredging in New Haven Harbor, Connecticut.

Name of contractor.	Date of contract.	Date of approval.	Work begun.	Character of contract.
John T. Regan, Chicago, Ill.....	June 23, 1899	July 20, 1899	Dec. 8, 1899	Continuing.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

[Through courtesy of Mr. Henry C. Rowe, chairman of harbor committee.]

FOREIGN.¹

Value of imports.....	\$216,740. 80
Revenue receipts.....	50,038. 35

Arrival and departure of vessels.

Foreign vessels:	
Entered.....	44
Cleared.....	35
Total.....	79
Domestic vessels:	
Entered.....	1,457
Cleared.....	1,440
Total.....	2,897

¹Furnished by Mr. J. Rice Winchell, deputy collector of customs.

Net tonnage of vessels owned at this port.

	Number.	Gross tons.	Net tons.
Steamers	80	30,089	19,368
Sailing vessels.....	111	32,815	29,679
Barges.....	118	18,198	17,792
Total	309	81,102	66,839

COASTWISE.

Arrival and departure of vessels. (a)

[Draft, 6 to 22 feet; tonnage, 100 to 2,000 tons.]

Kind of vessel.	Number of round trips.	Aggregate tonnage of all trips.
Steamers of all kinds	13,648	3,097,500
Sailing vessels	6,750	4,541,000
Barges in tow, scows, etc	8,295	3,875,000
Total.....	28,693	11,513,500

^a Reported by Mr. Henry C. Rowe to be practically the same for 1900 as for 1899. Portions of the statistics for 1899 are therefore copied verbatim. All quantities are estimates.

Freight received and shipped.

Chief articles.	Tons.	Estimated value.
Coal received:		
Bituminous	691,500	\$2,351,000
Anthracite.....	507,000	2,257,550
Iron received and shipped.....	176,700	5,125,000
Lumber received, 78,000,000 feet.....	117,000	1,130,000
Oysters received and shipped, 1,500,000 bushels.....	60,000	780,000
Miscellaneous merchandise:		
Received.....	1,020,000	115,000,000
Shipped.....	900,000	135,000,000
Total.....	3,472,200	261,643,550

The above figures show an apparent increase of 31,500 tons over the amount reported for 1899.

No new lines of transportation have been established during the year.

E 8.

CONSTRUCTION OF BREAKWATERS AT NEW HAVEN, CONNECTICUT.

Project.—To build four breakwaters at the entrance to New Haven Harbor, with lengths of 3,450 feet, 5,000 feet, about 3,000 feet, and 1,200 feet, aggregating 12,650 feet, at a total estimated cost of \$2,151,134.

To complete the project requires the building of the northeast breakwater, which has not yet been begun; extending the west breakwater the remaining 2,710 feet; extending the Luddington Rock breakwater the remaining 500 feet; increasing the cross section of the breakwaters now built to project dimensions or to such extent as seems to be required. No failure has occurred thus far, due to the reduced cross section at which the first three breakwaters were built.

The last work on these breakwaters closed February 1, 1897, an aggregate length of 9,440 feet having thus been built.

During the last fiscal year a light was maintained on the west breakwater.

New Haven, the port of entry for the collection district of New Haven, is situated at the head of New Haven Harbor, about 4 miles north of the breakwaters. There is a light-house on Southwest Ledge, the west terminus of the east breakwater. The nearest fortification is Fort Terry, N. Y., 37 miles east.

Money statement.

July 1, 1900, balance unexpended	\$1,500.86
June 30, 1901, amount expended during fiscal year	240.00
July 1, 1901, balance unexpended	1,260.86
{ Amount (estimated) required for completion of existing project	1,316,134.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	100,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

Appropriations for constructing breakwater at New Haven, Conn., have been made as follows:

Application.	Date.	Amount.
Easterly breakwater	Mar. 3, 1879	\$30,000
Do	June 14, 1880	30,000
Do	Mar. 3, 1881	60,000
Do	Aug. 2, 1882	60,000
Do	July 5, 1884	40,000
Do	Aug. 5, 1886	75,000
Do	Aug. 11, 1888	75,000
Middle or Luddington Rock breakwater	Sept. 19, 1890	120,000
Do	July 13, 1892	120,000
Middle and west breakwater	Aug. 18, 1894	125,000
West breakwater	June 3, 1896	100,000
Total		835,000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

These statistics have not been received. The last statement obtained was for 1895, which is as follows:

Vessels passing New Haven breakwater.

Men-of-war	16
Steamers of all kinds	43,200
Steamships	1,800
Ships, barks, and brigs	1,690
Schooners and sloops of all kinds	54,250
Barges in tow, scows, etc.	50,400
Total	151,356

These records are not complete, as some vessels pass unobserved in the night or in thick weather.

During the same year 92 vessels were observed under and close to the breakwater for refuge, and in the mouth of the harbor, partly under the protection of the breakwaters, 3,925 vessels were observed.

E 9.

IMPROVEMENT OF HOUSATONIC RIVER, CONNECTICUT.

Project.—To make and maintain a channel 7 feet deep at mean low water from Long Island Sound to the head of navigation, about 13 miles, to be 100 feet wide in the river and 200 feet wide over the bar at the mouth; to remove Drews Rock, build a jetty at Sow and Pigs Reef, a dike at the bend below Stratford, and a breakwater 5,750 feet long to protect the channel over the bar at the mouth of the river, all at an estimated cost of \$275,500. Up to July 1, 1900, this project required only the enlargement of the breakwater, an extension of the dike, and dredging on the bars to make it complete.

Under the appropriation of \$15,000 in the act of March 3, 1899, a contract was entered into March 22, 1900, with the Newburgh Dredging Company, at 28 cents per yard, to cover the work of restoring the channels on the several bars between Stratford and Derby. This contract was in force at the beginning of the fiscal year. Work was begun August 11 and completed September 25. The total quantity removed was 21,514 yards; of this amount, 6,241 yards were dredged at Oro-nock bar, 8,010 at Mill bar, and 7,263 at Drews bar. All dredged material was pumped ashore on the meadow above Mill bar on the east bank. When work ceased the channels across the bars were left clean at project depth (7 feet at mean low water), but with somewhat less than project widths. The balance of the appropriation (about \$9,500) was reserved for permanent work.

The Housatonic River is the boundary between the collection districts of New Haven and Fairfield. The nearest light-house is on Stratford Point, at the mouth of the river. The nearest work of defense is Fort Schuyler, Throgs Neck, about 43 miles to the southwest.

Money statement.

July 1, 1900, balance unexpended	\$15,911.33
June 30, 1901, amount expended during fiscal year.....	6,668.32
July 1, 1901, balance unexpended	9,243.01
(Amount (estimated) required for completion of existing project.....	47,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$20,000.00
For maintenance of improvement.....	4,000.00
	24,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for improving Housatonic River, Connecticut, have been made as follows:

Application.	Date.	Amount.
Sow and Pigs Jetty, dredging.....	Mar. 3, 1871	\$15,000
Drew Rock Jetty, dredging	June 10, 1872	15,000
Dredging	Mar. 3, 1873	10,000
Do	June 23, 1874	10,000
Do	Mar. 3, 1875	5,000
Do	June 18, 1878	5,000
Do	June 14, 1880	2,000
Do	Mar. 3, 1881	2,000
Removing Dew Rock and Jetty in 1887	Aug. 2, 1882	2,000
Do	July 5, 1884	2,500
Do	Aug. 5, 1886	5,000
Commencing breakwater, dredging	Aug. 11, 1888	35,000
Extending breakwater, dredging.....	Sept. 19, 1890	35,000
Extending breakwater, dike and dredging.....	July 13, 1892	20,000
Do	Aug. 18, 1894	25,000
Enlarging breakwater and dredging	June 3, 1896	25,000
Dredging	Mar. 3, 1899	15,000
Total.....		228,500

1176 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Contract in force July 1, 1900.

Name of contractor.	Date of contract.	Date of approval.	Work begun.	Contract completed.
Newburgh Dredging Co.....	Mar. 22, 1900	May 9, 1900	Aug. 11, 1900	Sept. 25, 1900

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through the courtesy of Capt. John W. Ferrett, Bridgeport, Conn.]

DERBY AND SHELTON.

Arrival and departure of vessels.

[Draft 2 to 8½ feet; tonnage 3 to 450 tons.]

Kind of vessel.	Number of round trips.	Aggregate tonnage.
Steamers and tugs.....	668	} 195, 915
Sailing vessels and yachts.....	100	
Barges.....	415	
Total.....	1, 183	.....

Freight received by water.

Chief articles.	Tons.	Estimated value.
Coal.....	148, 115	\$592, 460
Bricks.....	4, 160	66, 560
Lumber.....	24, 600	492, 000
Building materials.....	10, 000	125, 000
Pig iron.....	1, 548	12, 384
Emery.....	300	15, 000
Molding sand.....	6, 332	18, 996
Machinery.....	395	19, 750
Oysters and fish.....	500	10, 000
Total.....	195, 950	1, 352, 150

STRATFORD.

Arrival and departure of vessels.

Kind of vessel.	Number of round trips.	Aggregate tonnage.
Steamers and tugs.....	400	} 53, 235
Sailing vessels and yachts.....	600	
Barges.....	60	
Total.....	1, 060	.....

Freight received and shipped by water.

Chief articles.	Tons.	Value.
Coal.....	26, 355	\$95, 420
Building materials.....	5, 000	65, 000
Oysters, shells, and fish.....	21, 300	135, 750
Ship timber.....	80	3, 200
Miscellaneous.....	500	1, 500
Total.....	53, 235	300, 870

Many vessels go to the marine railways at Stratford for repairs, but no reliable record of their number is available.

The total tonnage reported above, 249,185 tons, shows an increase of 165,985 tons when compared with the report of 1897, which was the last report covering the commerce of the entire river.

The total estimated value of this commerce is \$1,553,020.

E 10.

IMPROVEMENT OF BRIDGEPORT HARBOR, CONNECTICUT.

Project.—(a) To dredge a main channel 18 feet deep, 300 feet wide south of the inner beacon and 200 feet wide north of it; an anchorage basin 18 feet deep, 2,000 feet by 500 feet; two anchorage basins 12 feet deep; channels 12 feet deep, 100 feet wide, and 1 mile long each, in Poquonnock River and Yellow Mill Cove; channels 9 feet deep, 100 feet wide, and three-fourths, one-eighth, and one-half mile long, in Johnsons, Cedar, and Burr creeks, respectively, estimated to require the removal of 2,226,500 yards; (b) to deliver and place stone for the repair and maintenance of the four breakwaters now built and for the construction and maintenance of shore protection on Fayerweather Island, estimated to require 12,500 tons; all at an estimated cost of \$300,000.

Under continuing contract with Hughes Bros. & Bangs, entered into July 31, 1899, work was first begun July 9, 1900. It consisted in dredging in the main channel and anchorage basin near the lower bridge, and in delivering stone on the east breakwater and the Fayerweather Island jetties. Dredging was discontinued September 5, when 257,783 yards had been removed. Stonework was discontinued September 25, when 8,782 tons had been delivered, and used as follows:

In repairing the east breakwater, and extending it 380 feet, 5,081 tons; in building four jetties, aggregating about 900 feet in length, on the west shore of Fayerweather Island, 3,701 tons.

In accordance with the terms of the contract (see p. 1339 of annual report of 1900), that portion of the above work which was done after the expiration of the time limit (originally July 31, but afterwards extended to August 31, 1900) was paid for at a lower rate; namely, 9,160 yards dredging at $2\frac{1}{2}$ cents per yard, and 1,353 tons of stone in place at \$1 per ton. Work was resumed January 15, 1901, and again discontinued June 11. During this period 200,458 yards were dredged, all of which was paid for at $2\frac{1}{2}$ cents per yard. There remains 164,722 yards to be dredged in order to consume the balance of the first appropriation (\$50,000 in act of March 3, 1899). The second appropriation (\$50,000 in act of June 6, 1900) is as yet untouched. It has been available since July 26, 1900, and such part as is not earned at 5 cents per yard on or before July 26, 1901, must, according to the terms of the contract, be earned afterwards at $2\frac{1}{2}$ cents per yard. The third appropriation (\$50,000 in act of March 3, 1901) is held in reserve for the present, and no notice that it must be earned within a specified time has been sent to the contractors. The results obtained at the end of the fiscal year June 30, 1901, include, besides the dredging and stonework heretofore described, the dredging of 40,756 yards in the 18-foot channel below the Naugatuck Railroad dock, mostly in the vicinity of

the outer beacon; 18,079 yards in the 9-foot channel extending up Johnsons River, completing it to a point about 700 feet above Pleasure Beach wharf; and 141,623 yards in the 12-foot channel extending up the Poquonnock River, completing it to within about 500 feet of the project length.

Bridgeport, the port of entry for the collection district of Fairfield, is situated about 2 miles from Long Island Sound, at the head of Bridgeport Harbor. There is a light-house at the entrance to the harbor and a small harbor light at the Inner Beacon; also two lights at the entrance to Black Rock Harbor, the outer one at Penfield Reef, the inner on Fayerweather Island.

Fort Schuyler, Throgs Neck, at the head of Long Island Sound, is about 41 miles to the southwest, and is the nearest work of defense.

Money statement.

July 1, 1900, balance unexpended.....	\$100, 151. 50
Amount appropriated by sundry civil act approved March 3, 1901.....	50, 000. 00
	150, 151. 50
June 30, 1901, amount expended during fiscal year.....	36, 300. 87
July 1, 1901, balance unexpended.....	113, 850. 63
July 1, 1901, outstanding liabilities.....	3, 754. 59
July 1, 1901, balance available.....	110, 096. 04
July 1, 1901, amount covered by uncompleted contracts.....	104, 090. 25

Appropriations for the improvement of Bridgeport Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
Dredging outer bar	July 4, 1836	\$10, 000
Dredging outer and inner bars	Aug. 30, 1852	10, 000
		\$20, 000
Dredging and 521 feet of breakwater	Mar. 3, 1871	20, 000
Dredging and 859 feet of breakwater	June 10, 1872	40, 000
Dredging inner bar and upper harbor	Mar. 3, 1873	30, 000
Dredging, bridge to Long Island Sound (9 feet)	June 23, 1874	20, 000
Dredging, bridge to Long Island Sound (12 feet)	Mar. 3, 1875	15, 000
Dredging upper harbor (9 feet)	Aug. 14, 1876	10, 000
Dredging above bridge and outer bar (9 and 12 feet)	June 18, 1878	10, 000
Dredging, bridge to Long Island Sound (12 feet)	Mar. 3, 1879	10, 000
Do	June 14, 1880	10, 000
Dredging about inner beacon (12 feet)	Mar. 3, 1881	10, 000
Dredging between inner beacon and railway wharf (12 feet)	Aug. 2, 1882	10, 000
Do	July 5, 1884	5, 000
Do	Aug. 5, 1886	20, 000
Dredging above horse-railroad bridge (9 feet)	Aug. 11, 1888	10, 000
Dredging and breakwater at Tongue	Sept. 19, 1890	20, 000
Dredging between inner beacon and Naugatuck wharf	July 13, 1892	20, 000
Dredging outer bar (15 feet)	Aug. 18, 1894	10, 000
Dredging between outer beacon and Long Island Sound	June 3, 1896	28, 000
Dredging and stonework	Mar. 3, 1899	50, 000
Do	June 6, 1900	50, 000
Do	Mar. 3, 1901	50, 000
		448, 000
Total		468, 000

All appropriations except the last three were applied to previous projects.

Contract in force June 30, 1901, for stonework and dredging in Bridgeport Harbor, Connecticut.

Name of contractor.	Date of contract.	Date of approval.	Work begun.	Character of contract.
Hughes Bros. & Bangs	July 31, 1899	Aug. 25, 1899	July 9, 1900	Continuing.

COMMERCIAL STATISTICS FOR THE YEAR 1900.

[Through the courtesy of Frank J. Naramore, collector of customs, Bridgeport, Conn.]

FOREIGN.

Value of imports.....	\$476,358.00
Revenue receipts.....	146,277.65

Foreign vessels:

Entered.....	8
Cleared.....	8

Total.....	16
------------	----

Net tonnage of vessels owned at this port.

Kind of vessel.	Number.	Tons.
Steamers.....	34	5,852
Sailing vessels.....	71	3,939
Barges.....	3	778
Total.....	108	10,569

The number of vessels given as owned at this port covers only those of over 5 tons measurement.

COASTWISE.

Arrival and departure of vessels.

[Draft, 12 to 18 feet; tonnage, 100 to 1,250 tons.]

Kind of vessel.	Number of round trips.	Aggregate tonnage of all trips.
Steamers.....	6,790	} a 1,240,000
Sailing vessels.....	5,172	
Barges.....	5,500	
Total.....	17,462	

a Estimated.

Freight received and shipped.

Chief articles.	Estimated tons.	Estimated value.
Coal received and shipped.....	950,760	\$3,803,040
Iron received and shipped.....	34,500	439,000
Lumber received, 30,159,300 feet.....	25,000	452,390
Oysters received and shipped, 500,000 bushels.....	1,000	400,000
Miscellaneous merchandise:		
Received.....	102,700	8,176,000
Shipped.....	50,000	4,040,000
Total.....	1,163,960	17,310,430

The amount of coastwise freight reported above is 149,396 tons more than reported for 1899.

E 11.

IMPROVEMENT OF SAUGATUCK RIVER AND WESTPORT HARBOR,
CONNECTICUT.

Project.—To dredge a channel 4 feet deep at mean low water and 60 feet wide up to the village of Westport, remove rocks and bowlders from the channel, and repair the breakwater at Cedar Point, at an estimated cost of \$18,000.

No work was done during the fiscal year from lack of sufficient funds.

The present condition of this improvement is practically the same as reported for last year (see p. 1342, annual report for 1900).

To complete the project requires the further removal of bowlders and dredging to secure project dimensions in the channel opposite Westport.

Saugatuck River is in the Fairfield collection district, of which Bridgeport is the port of entry. The nearest light-house is on Sheffield Island, 5 miles southeast from the river's mouth. Fort Schuyler, Throgs Neck, at the head of Long Island Sound, 32 miles southwest, is the nearest work of defense.

Money statement.

July 1, 1900, balance unexpended.....	\$537. 90
June 30, 1901, amount expended during fiscal year.....	11. 20
July 1, 1901, balance unexpended.....	526. 70
{ Amount (estimated) required for completion of existing project	5, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

Appropriations for this harbor have been made as follows:

Title.	Application.	Date.	Amount.
Survey of river and harbor at Saugatuck	Survey	May 20, 1826	\$400
Removing obstructions in river and protecting harbor at Cedar Point.	Chiefly constructing breakwater at Cedar Point.		
Removing obstructions in river.....	As stated, location not known....	Apr. 30, 1830	28
For further securing the beach at Cedar Point.	Continuing breakwater	July 4, 1836	1, 000
Harbor of Westport.....	Canal construction.....	do	3, 000
Do.....	do	May 3, 1837	3, 734
Do.....	do	July 7, 1838	4, 782
Deepening and improving Westport Harbor, unexpended balance reverted to Treasury in 1870; reappropriated in 1871.	Chiefly in surveys in 1872	Mar. 2, 1867	2, 500
Westport Harbor	Repairing and extending breakwater on Cedar Point.	July 11, 1870	2, 500
Saugatuck River, improvement of the natural channel.	Dredging	July 13, 1892	7, 000
Saugatuck River, for completion.....	do	Aug. 18, 1894	3, 000
Westport Harbor, Connecticut.....	Removal of rocks and repair of breakwater.	June 3, 1896	3, 000
Total			32, 444

The appropriations since 1892 have been applied to the present project.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through the courtesy of Mr. Rufus Wakeman, Saugatuck, Conn.]

Arrival and departure of vessels.

WESTPORT HARBOR.

[Draft, 4 to 10½ feet; tonnage, 50 to 300.]

Kind of vessels.	Estimated number of round trips.	Estimated aggregate tonnage of all trips.
Sailing vessels	14	2,100
Steamers of all kinds	60	10,000
Barges, scows, etc.	33	6,600
Total	107	18,700

Freight received and shipped by water.

Chief articles.	Estimated tons.	Estimated value.
Coal	12,000	\$48,000
Lumber (360,000 ft. B. M.)	360	14,400
Miscellaneous	6,340	14,500
Total	18,700	76,900

The amount of freight reported above is 1,800 tons less than reported for 1899.

E 12.

IMPROVEMENT OF NORWALK HARBOR, CONNECTICUT.

Project.—To remove the shoal at Ferrys Point to a depth of 6 feet at mean low water; to dredge a channel to South Norwalk, 150 feet wide and 10 feet deep at mean low water, and to widen the two bends at the harbor entrance—at a total estimated cost of \$77,000.

No work was done during the fiscal year, from lack of sufficient funds. No impairment of the dredged channel as to depth or width has been reported, and no examination or survey has been made since the completion of the work in August, 1899, when the available channel depths were 8 feet below, and 6 feet above the railroad bridge.

The project requires for its completion further widening of the lower bend, and dredging of the 10-foot channel below the bridge, about 1 mile in length, where present depths are 8 to 9 feet at mean low water.

Norwalk is in the Fairfield collection district, and is 11 miles west of Bridgeport, the port of entry. Norwalk light-house is on Sheffield Island, at the harbor entrance. The nearest work of defense is Fort Schuyler, Throgs Neck, at the head of Long Island Sound, about 29 miles southwest.

Money statement.

July 1, 1900, balance unexpended.....	\$169. 75
June 30, 1901, amount expended during fiscal year.....	5. 50
July 1, 1901, balance unexpended.....	164. 25
(Amount (estimated) required for completion of existing project.....	50,000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$23,000. 00
For maintenance of improvement.....	2,000. 00
	25,000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for improving Norwalk Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
For previous projects:		
Dredging (6 feet) above South Norwalk.....	June 10, 1872	\$10,000
Do.....	Mar. 3, 1873	10,000
Do.....	June 23, 1874	10,000
Dredging (6 feet) below South Norwalk.....	Mar. 3, 1875	7,000
Do.....	June 18, 1878	6,000
Dredging (6 feet) above and below South Norwalk.....	Mar. 3, 1879	10,000
Dredging (6 feet) below South Norwalk.....	June 14, 1880	5,000
Dredging (8 feet) below and (6 feet) above South Norwalk.....	Mar. 3, 1881	5,000
Dredging (6 feet) above South Norwalk.....	Aug. 2, 1882	5,000
Dredging (8 feet) below South Norwalk.....	July 5, 1884	5,000
Dredging (6 feet) above South Norwalk.....	Aug. 5, 1886	3,000
Dredging (6 feet) above and (8 feet) below South Norwalk.....	Aug. 11, 1888	3,000
Do.....	Sept. 19, 1890	4,000
Total.....		83,000
For present project, adopted 1894:		
Dredging (6 feet) at Ferrys Point.....	Aug. 18, 1894	\$15,000
Dredging (10 feet) below South Norwalk.....	June 3, 1896	10,000
Dredging.....	Mar. 3, 1899	2,000
Total for present project.....		27,000
Total appropriated for improvement of Norwalk Harbor, Connecticut.....		110,000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through the courtesy of Mr. John H. Ferris, South Norwalk, Conn.]

Arrivals and departures of vessels.

[Draft, 4 to 14 feet; tonnage, 50 to 600 tons.]

Kind of vessel.	Round trips.
Steamers of all kinds.....	628
Sailing vessels.....	124
Barges.....	279
Total.....	1,031

The above does not include the frequent trips made by small steamers and sail-boats employed in the oyster industry.

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Coal	88,700	\$334,100
Building materials	26,625	133,125
Miscellaneous materials	51,200	5,918,250
Oysters and shellfish	10,750	301,000
Total	172,275	6,686,475

The amount of freight reported above is 7,520 tons more than reported for 1899.

E 13.

IMPROVEMENT OF FIVE-MILE RIVER HARBOR, CONNECTICUT.

Project.—To dredge a channel 8 feet deep at mean low water and 100 feet wide from Long Island Sound to the head of the harbor, a distance of about 6,000 feet, at an estimated cost of \$45,000.

No work was done during the fiscal year from lack of sufficient funds. No impairment of the dredged channel as to depth or width has been reported, and no examination or survey has been made since the completion of work in June, 1899.

The project requires for its completion the dredging of the 8-foot channel 100 feet wide where the present width is 60 feet, and extending it up to the head of the harbor, a distance of about 1,500 feet, where the present depths are generally less than 2 feet.

Five-mile River is in the Fairfield collection district and is about 13 miles west of Bridgeport, the port of entry. The nearest light-house is on Sheffield Island, nearly 2 miles from the mouth of the harbor. The nearest work of defense is Fort Schuyler, at the head of Long Island Sound, 27 miles southwest.

Money statement.

July 1, 1900, balance unexpended	\$58.41
July 1, 1901, balance unexpended	58.41

{ Amount (estimated) required for completion of existing project	22,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

Appropriations for improving harbor at Five-mile River, Connecticut, have been made as follows:

Application.	Date.	Amount.
Dredging	Aug. 11, 1888	\$5,000
Do	Sept. 19, 1890	5,000
Do	July 13, 1892	5,000
Do	Aug. 18, 1894	2,500
Do	June 3, 1896	2,500
Do	Mar. 3, 1899	2,500
Total		22,500

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through the courtesy of Hon. Charles W. Bell, Rowayton, Conn.]

Arrival and departure of vessels.

FIVE-MILE RIVER HARBOR.

[Draft, 3 to 8 feet; tonnage, 40 to 104 gross tons.]

Kind of vessel.	Estimated number of round trips.
Steamers (including oyster steamers).....	1,500
Sailing vessels.....	a 9,000
Barges.....	14
Total	10,514

a Includes the numerous trips made by about 40 small oyster boats.

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Estimated receipts:		
Coal.....	2,200	\$11,000
Oysters.....	12,000	220,000
Miscellaneous (not otherwise included)	500	4,000
Total receipts.....	14,700	235,000
Estimated shipments:		
Oysters for foreign shipments	2,500	63,000
Other transactions in oysters and clams, sales to dealers, planters, and consumers, about.....	10,000	122,000
Oyster shells.....	5,400	16,200
Total shipments	17,900	201,200

The amount of freight reported above is 15,540 tons more than reported for 1897, which was the last report heretofore received.

E 14.

IMPROVEMENT OF STAMFORD HARBOR, CONNECTICUT.

Project.—To dredge (a) a channel in the West Branch 7 feet deep, 150 feet wide, and $1\frac{1}{2}$ miles long, with a basin between harbor lines at its head; and (b) a channel in the East Branch 9 feet deep, 100 feet wide for a length of 8,535 feet and 50 feet wide the remaining 1,200 feet to the head of the harbor; total estimated cost, \$123,500.

No work was done in this improvement during the year from lack of sufficient funds. No impairment of channel depths has been reported since the close of work in 1899, and it is believed that none has occurred. Completion of the project requires that channels and basins be dredged to full width and depth in the upper part of each branch of the harbor, and that the remaining boulders be removed from the East Branch.

Stamford Harbor is in the Fairfield collection district, of which Bridgeport is the port of entry. There is a light-house on the middle ground at the harbor entrance. The nearest work of defense is Fort Schuyler, Throgs Neck, 20 miles to the southwest.

Money statement.

July 1, 1900, balance unexpended	\$1, 248. 52
June 30, 1901, amount expended during fiscal year	14. 19
July 1, 1901, balance unexpended	1, 234. 33
July 1, 1901, outstanding liabilities	3. 00
July 1, 1901, balance available	1, 231. 33
{ Amount (estimated) required for completion of existing project	82, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

Appropriations for improving Stamford Harbor, Connecticut, have been made as follows:

Application.	Date.	Amount.
For previous projects:		
Dredging West Branch 5 feet deep	Aug. 5, 1886	\$10, 000
Do	Aug. 11, 1888	5, 000
Do	Sept. 19, 1890	5, 000
		\$20, 000
For the present project:		
Dredging and rock removal, East Branch, \$13,800; dredging West Branch, \$1,200	July 13, 1892	15, 000
Dredging and rock removal, East Branch, \$5,000; dredging West Branch, \$5,000	Aug. 18, 1894	10, 000
Dredging West Branch	June 3, 1896	10, 000
Dredging	Mar. 3, 1899	6, 000
		41, 000
Aggregate		61, 000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through the courtesy of Mr. Charles H. Leeds, deputy collector of customs.]

Arrival and departure of vessels.

[Draft, 5 to 15 feet; tonnage, 20 to 550 tons.]

Kind of vessels.	Round trips.
Steamers	1, 081
Sailing vessels	289
Barges	671
Total	2, 041

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Coal	80, 500	\$425, 000
Building materials	18, 516	185, 000
Miscellaneous	167, 862	5, 575, 000
Total	266, 878	6, 185, 000

The above figures show an increase of 9,191 tons of freight from that reported for 1899.

This report includes all the harbor of Stamford, east and west sides.

E 15.

IMPROVEMENT OF HARBOR AT COSCOB AND MIANUS RIVER,
CONNECTICUT.

Project.—To dredge a channel 1.2 miles in length, 6 feet deep at mean low water, 150 feet wide from the 6-foot curve in the harbor to the bridge, 0.4 mile, and thence 100 feet wide to the head, 0.8 mile; also a turning basin near the lower end 300 by 1,750 feet and 7 feet deep at mean low water, at an estimated cost of \$54,000.

No work was done during the fiscal year, from lack of sufficient funds. No impairment of the dredged channel as to depth or width has been reported, and no examination or survey has been made since the completion of work in July, 1899.

The project now requires for its completion the dredging of the remaining half of the 7-foot turning basin and extending the 6-foot channel 100 feet wide up the harbor to its head, a distance of about 0.5 mile, where the present depths are about 2 feet.

Coscob Harbor and Mianus River are in the collection district of Fairfield, Conn., of which Bridgeport is the port of entry. The nearest light-house is on Great Captains Island, about 2 miles southwest from the harbor entrance. Fort Schuyler, Throgs Neck, New York, 18 miles to the southwest, is the nearest work of defense.

Money statement.

July 1, 1900, balance unexpended	\$170. 31
July 1, 1901, balance unexpended	170. 31
{ Amount (estimated) required for completion of existing project	35, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	10, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

Appropriations for improving Coscob Harbor and Mianus River have been made as follows:

Application.	Date.	Amount.
Dredging below railway bridge	July 13, 1892	\$7, 000
Dredging above railway bridge	Aug. 18, 1894	4, 000
Dredging turning basin and above railway bridge	June 3, 1896	8, 000
Total		19, 000

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

[Through the courtesy of Mr. E. F. Lockwood.]

Arrivals and departures of vessels.

[Draft, 4 to 8 feet; tonnage, 25 to 100 tons.]

Kind of vessel.	Number of vessels.	Number of trips.	Aggregate tonnage of all trips.
Steamers	2	500	15, 000
Sailing vessels	63	63	1, 650
Barges	34	34	4, 900
Total	99	597	21, 550

a Does not include "several oyster sloops, a few score of yachts, both steam and sail, and several tugs that go to Mianus when the tide is high."

Chief articles.	Tons.	Estimated value.
Receipts: Coal, timber, oysters, hardware, shipbuilding materials, and general merchandise.....	7,900	\$123,000
Shipments: Ice, car sweepers, oysters, fish, and farm produce.....	2,000	30,000
Total.....	9,900	153,000

The amount of freights reported above is 540 tons more than reported for 1899.

In this report Mr. Lockwood repeats his former statement as regards the present need of continuing the dredging in the upper part of the harbor.

E 16.

IMPROVEMENT OF GREENWICH HARBOR, CONNECTICUT.

Project.—To dredge a channel 90 feet wide from the mouth of the harbor to a causeway at its head, to be 9 feet deep at mean low water to the lower docks, a distance of half a mile, and 6 feet deep above, a distance of half a mile; the upper end is to be slightly enlarged, to form a turning basin; all at an estimated cost of \$20,000.

No work was done on this improvement during the fiscal year from lack of sufficient funds. Since the completion of work in January, 1898, no impairment of the dredged channel as to width or depth has been reported and no examination or survey has been made.

The project now requires for its completion dredging the 9-foot channel its full length where depths are now from 6 to 9 feet, and dredging the remaining half of the 6-foot channel along the docks to obtain full width where the depths now average about 2 feet, and the width is 45 feet.

Greenwich Harbor is in the collection district of Fairfield Conn., of which Bridgeport is the point of entry. The nearest light-house is on Great Captains Island, about 2 miles southward. The nearest work of defense is Fort Schuyler, Throgs Neck, N. Y., about 16 miles to the southwest.

Money statement.

July 1, 1900, balance unexpended	\$878. 15
June 30, 1901, amount expended during fiscal year.....	26. 00
July 1, 1901, balance unexpended	851. 55
{ Amount (estimated) required for completion of existing project	14,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	14,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The only appropriation for improving Greenwich Harbor, Connecticut, is the one of \$6,000 made by the river and harbor act of June 3, 1896.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1900.

These statistics have been asked for, but have not been received. The last report received was for 1897, as follows:

Arrivals and departures of vessels.

[Draft, 3 to 14 feet; tonnage, 40 to 750 tons.]

Kind of vessel.	Number of round trips.
Steamer Maid of Kent, passenger and freight line	Daily trips.
Sailing vessels, schooners, brigs, and sloops	Do.
Steam barges, steam canal boats, and steam lighters	Weekly trips.
Coal barges (in tow of tugs)	Two and three each week.

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Coal	25,000	\$125,000
Lumber, 15,000,000 feet	15,000	2,500,000
Brick, 12,000,000	24,000	75,000
Gravel, 30,000 cubic yards	35,000	45,000
Trap rock, 30,000 cubic yards		
Crushed stone, 30,000 cubic yards	9,000	75,000
Lime, 60,000 barrels		
Cement, 60,000 barrels	2,500	15,000
Plaster, 60,000 barrels		
Wall plaster and mortar in bags	2,500	450,000
Grain, 500,000 bags	13,000	22,500
Quarried stone, 7,500 cubic yards	5,000	125,000
Miscellaneous, tile pipe, iron pipe, bluestone flagging, etc	45,000	2,000,000
General freight by propeller Maid of Kent (150 tons each trip)		
Total	176,000	5,432,500

The above figures show an increase of 66,500 tons over the report for 1894, which was the only one received heretofore.

E 17.

EXAMINATION AND SURVEY OF BRANFORD HARBOR, CONNECTICUT.

[Printed in House Doc. No. 100, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 23, 1900.

SIR: I have the honor to submit the accompanying copies of reports dated September 12 and November 2, 1900, by Maj. Smith S. Leach, Corps of Engineers, upon preliminary examination and survey, respectively, of Branford Harbor, Connecticut, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

Major Leach submits a project for improvement by dredging a channel 100 feet wide and $8\frac{1}{2}$ feet deep at mean low water through the upper part of the Branford River, from the lower to the upper docks, at an estimated cost of \$5,000, and \$250 per annum for maintenance. He considers the locality to be worthy of improvement by the General Government, and his views are concurred in by Col. G. L. Gillespie, Corps of Engineers, Division Engineer.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF BRANFORD HARBOR, CONNECTICUT.

UNITED STATES ENGINEER OFFICE,
New London, Conn., September 12, 1900.

GENERAL: Pursuant to the provisions of the act of Congress approved June 6, 1900, making provision for emergencies in river and harbor works, for certain surveys, etc., and instructions conveyed in Department letter of June 13, 1900, I have the honor to submit the following preliminary report upon Branford Harbor, Connecticut.

This harbor was the subject of a preliminary examination followed by a survey and report thereon in 1883 (Report, Chief of Engineers, 1884, Part I, pp. 678-681), from which reports and from the latest Coast Survey map of the locality the physical description of the harbor herein presented is derived.

Branford Harbor, Connecticut, shown on sheet 261, Coast and Geodetic Survey, is on the north shore of Long Island Sound, a few miles east of New Haven. The harbor affords access to and terminal facilities at the town of Branford, of about 5,000 inhabitants, with manufacturing and general commercial interests. Taken in its commercial sense, the harbor of Branford consists of a narrow, tortuous, tidal stream 2 miles long, and an inner and outer bay. The inner bay is roughly circular in shape, with a diameter of one-half mile, and the outer bay is approximately a mile square. The two are separated by the projecting point of Indian Neck on the east and a chain of rocks, the two largest and principal ones being known as the Big and Little Mermaids. The outer half of the outer bay has a depth of 12 to 18 feet, and the inner half 9 to 12 feet. The prevailing depth of the inner bay is 5 to 9 feet. The lower half of the river is relatively deep, exhibiting soundings of 10 to 17 feet at low water. The upper half of the river is shoaler, no soundings being shown on the Coast Survey chart, but from personal observation and other sources of information I conclude that the prevailing low-water depth is 2 to 3 feet in a narrow channel. There are two bridges, one at the upper end of the river as described and the other half a mile below. The latter has a narrow sliding draw. The portion between the bridges has no docks or other terminal facilities, and gives evidence of no present or prospective navigation. Just below the lower bridge is the site of the Malleable Iron Works, a large concern employing several hundred people and receiving and shipping considerable quantities of materials and finished product by water. From the point where the river debouches into the upper bay to a point between the Mermaids, a distance of about half a mile, the prevailing depth is about 8 feet at low water with a bottom mainly of soft mud. From this point outward, 9 feet can be carried at low water.

The natural depth of the harbor therefore appears to be 8 feet at low water; and, to augment that depth, it will be necessary to dredge through the inner bay from the mouth of the river to the Mermaids to give an additional foot, and a farther distance outward to give any more. But in the river's present condition some of the principal industries can not be reached with the full natural low-water depth of the harbor; and this would appear to be a condition demanding a remedy, which can be found in extending by dredging a channel of 8 feet depth with proper width over about a half to three-eighths of a mile immediately below the lower bridge. This measure of improvement

at least, provided there are no difficulties to greatly enhance its cost, appears from present information to be a reasonable concession to the interests involved; and I have therefore the honor to state that, in my opinion, the harbor of Branford is worthy of improvement.

The cost of a survey will be nominal, and no estimate therefor is submitted. The commerce of the harbor of Branford, as furnished me, under date of August 31, by Mr. Alfred E. Hammer, president of the Branford Board of Trade, is as follows:

Tonnage of the port for one year.

INCOMING.		Tons.
Iron.....		8, 274
Coal.....		19, 283
Molding sand, etc.....		5, 345
Lumber.....		1, 363
Feed.....		280
Fertilizer.....		350
Total.....		34, 895

OUTGOING.		
Coal.....		80
Supplies.....		40
Total.....		120

Stone quarries in Branford River and Harbor proper, when working, send out 3,000 to 4,000 tons per month, or estimated 40,000 tons per year.

Very respectfully, your obedient servant,

SMITH S. LEACH,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, September 13, 1900.

Respectfully forwarded to the Chief of Engineers, concurring in the views of the district officer.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 15, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Branford Harbor, Connecticut, required by the provisions of the emergency river and harbor act of June 6, 1900.

The harbor is reported to be worthy of improvement, and I recommend that a survey be made and the cost of improvement proposed be estimated.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
September 18, 1900.

Approved as recommended by the Chief of Engineers.

G. D. MEIKLEJOHN,
Acting Secretary of War.

SURVEY OF BRANFORD HARBOR, CONNECTICUT.

UNITED STATES ENGINEER OFFICE,
New London, Conn., November 2, 1900.

GENERAL: I have the honor to submit the following report upon a survey of Branford Harbor, Connecticut, made in pursuance of a provision of the act of Congress approved June 6, 1900, the survey having been preceded by a preliminary examination and favorable report, as required by law.

This locality was the subject of a preliminary examination made in 1882, followed by a survey in 1883, under a provision of the act of August 2, 1882. The reports are printed in the Annual Report of the Chief of Engineers, 1884, pages 678-681.

The field work of the survey, done at nominal cost, occupied parts of two days, October 16 and 17, and had for its object to correct to date the result of prior surveys. To establish a tidal reference, a series of readings was taken at New Haven simultaneous with those of October 16 at Branford. A comparison of the two curves indicates that, except as to synchronism, the tidal regimen is substantially identical at the two places. The plane of mean low water at Branford is taken at the same elevation as at New Haven. An inspection of the New Haven record indicates that tides 1 foot below mean low water occur with sufficient frequency to make them of importance from the navigation standpoint. "Low water" as used in this report is therefore taken at 1 foot below mean low water at New Haven, and all depths herein given have reference to the plane of that low water unless otherwise indicated. The mean rise of tide is 6 feet.

The harbor of Branford is the lower part of a small tidal stream called Branford River, and a small bay or indentation in the north shore of Long Island Sound, a short distance east of New Haven, through which the river debouches. The bay is about a mile wide and a mile and a half long, with rocky shores, and two detached rocks called "The Mermaids," rising above high water near the middle of the bay and about 100 yards apart. The depth of water across the mouth of the bay is about 15 feet at low water, and it shoals gradually to 7½ feet between The Mermaids. Thence to the junction of bay and river it is very uniform at 7½ feet below low water. A 6-foot lump, shown on the published Coast Survey Chart No. 261, could not be

found, and is believed to have disappeared. Local fishermen who have repeatedly raked the bay for clams assert that the entire bed is perfectly level. Certain riprap stones accidentally deposited on the bottom, and the removal of which was suggested in the report on the preliminary examination of 1882, have also disappeared, and have probably buried themselves in the mud.

The channel of Branford River to and above the town, while resting at points against bluff and rocky banks, has in the main the character of a swamp drain, or coul  , a mere depression in a broad area of swamp or salt meadow, without definite margins and of very soft material.

About 2 miles above the mouth of the river navigation is interrupted by a stone causeway with two openings or sluices hung with tide gates. These gates, which appear to be in working condition, limit the full rise and fall of tide to the river below them, and thus reduce the tidal prism, upon which the size of the natural channel depends. One and five-eighths miles above its mouth the river is crossed by a wooden trestle bridge with a rolling draw over the channel. This bridge is in a dilapidated condition and at the time of the survey was closed to teams. There is no evidence of recent navigation above this bridge.

Immediately below the bridge, on the west side of the river, are a coal and lumber yard and the extensive works of the Malleable Iron Fittings Company. There is a substantial dock along the combined front, with a depth of 4 to 5 feet along the upper half and 3 to 4 feet along the lower, the latter obtained by private dredging since the former survey. A short distance below, a mile and a quarter from the mouth of the river, is another coal pocket, having an available depth of $7\frac{1}{2}$ feet at low water along its front.

The limiting low-water depth through the bay to the mouth of the river is $7\frac{1}{2}$ feet. The lower river presents low-water depths, in a channel of navigable width, of from 9 feet at a single point just inside the mouth to 11 feet and upward, then shoaling to $7\frac{1}{2}$ feet at the lower coal dock. From the lower coal dock to the upper dock the channel gradually shoals, though not regularly, to 3 feet at low water at and near the docks, which is the limiting depth for navigation to the upper docks. It is to be noted that this corresponds to 9 feet at average high water.

It appears, then, that the present navigable capacity of Branford Harbor—its natural capacity—is $7\frac{1}{2}$ feet at the assumed low water, 1 foot below mean low water. The occasions when any arriving vessel will find less than the depth stated will be so few that they may be neglected. This depth can be carried to the lower coal dock, but the natural depth can not be carried to the upper docks, where a large part of the business is done, and which can be reached with no greater draft than 3 feet at the assumed low water, though the depth in the greater part of the channel to be traversed is somewhat more.

The improvements which local opinion demands are set forth in a communication from Mr. Alfred E. Hammer, president Branford Board of Trade, which is appended hereto, and to which attention is invited. Depths of 10 feet at mean low water in the upper harbor and 12 feet in the lower are desired, as also a breakwater from Indian Neck to The Mermaids, to convert the inner bay into a harbor of refuge. To extend the natural depth of $7\frac{1}{2}$ feet at the assumed low water, or $8\frac{1}{2}$ feet at mean low water, to the upper wharves, so as to make this depth available for all the commerce of the harbor, would

require the dredging of about 20,000 cubic yards of soft material, estimated to cost, including inspection and administration, \$5,000.

To increase the natural depth to 9 feet at low water, or 10 feet at mean low water, would require dredging over the same area in the upper harbor to a greater depth, and, in addition, dredging through the bay from The Mermaids into the river. The total required may be stated at 120,000 cubic yards, which will probably cost, including inspection and administration, \$25,000.

To secure a greater depth than 9 feet at low water, or 10 feet at mean low water, the dredging must be carried through the river, except the deepest reaches, and must be extended outside The Mermaids a distance of several hundred feet for each foot of additional depth desired.

In my opinion, Branford Harbor is neither by its area, depth, nor situation adapted to use as a refuge for any commerce except its own; and its own can find adequate shelter by going into the mouth of the river. Hence no expenditure for a breakwater seems justifiable.

As compared with other harbors in this district for which improvements have been projected, a depth of $7\frac{1}{2}$ feet at the lowest of prevailing low waters, or $13\frac{1}{2}$ feet at corresponding high waters, appears to me to be fairly commensurate with a commerce of the kind and amount which Branford Harbor possesses. This commerce is given in the appended letter of Mr. Hammer, above referred to. It amounts to 34,000 tons per annum of incoming, and 120 tons of outgoing freight. There is also an estimate of 40,000 tons per annum for the granite quarries if they could be operated. As many quarries which have excellent water facilities are idle, it can not be assumed that the improvement of the harbor will make these quarries active. I note that these figures are substantially the same as were reported to the officer who made the former survey, twenty-seven years ago.

Vessels entering the harbor with its natural draft may reasonably claim the privilege of carrying this draft to the upper docks and of lying in the adjacent channel without grounding at low water. I therefore submit, as a project for the improvement of Branford Harbor, the development and maintenance by dredging of a channel 100 feet wide and $8\frac{1}{2}$ feet deep at mean low water through the upper part of the river between the lower and upper docks, at an estimated cost of \$5,000 for opening the channel, and \$250 per annum for its maintenance.

I consider the harbor of Branford worthy of improvement by the United States to the extent above recommended.

Very respectfully, your obedient servant,

SMITH S. LEACH,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, November 6, 1900.

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in the views of the district officer.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

LETTER OF THE BRANFORD (CONN.) BOARD OF TRADE.

BRANFORD, CONN., *August 31, 1900.*

DEAR SIR: In further reply to yours of August 13 I would give you the following data regarding the improvements desired in Branford Harbor and River:

First. Depth at low water desired: Ten feet in river channel at upper part and 12 feet at the harbor bar.

Second. Location: Channel to be deepened from Indian Neck Avenue Bridge, just above factory of Malleable Iron Fittings Company, to point below Dutch House wharf (so-called), where the channel is now the desired depth.

Removal of bar at the mouth of the harbor, east of Mermaids.

Breakwater to be constructed from southeast point of Mermaids to Indian Neck Point.

Third. Tonnage of the port for one year as follows:

INCOMING.

Malleable Iron Fittings Company (July, 1899, to July, 1900):		Tons.
Iron.....	.....	6,000
Coal.....	.....	7,665
Molding sand.....	.....	2,330
Fire and core sand.....	.....	1,063
Fire clay.....	.....	255
Yale & Towne Manufacturing Company (year 1899):		
Coal.....	.....	4,095
Clay and molding sand.....	.....	1,695
Iron.....	.....	897
F. Jourdan & Son (year 1899):		
Coal.....	.....	2,823
Lumber.....	.....	1,363
S. V. Osborn (July, 1899, to July, 1900):		
Coal.....	.....	4,700
Feed.....	.....	30
Branford Electric Railway Company:		
Rails and trap rock.....	.....	1,377
M. C. Prout, freighter:		
Feed.....	.....	250
Fertilizer.....	.....	179
E. R. Kelsey, fertilizer.....		175
Total.....	.....	34,897

OUTGOING.

S. V. Osborn, coal.....	80
E. R. Kelsey, supplies.....	40

Stone quarries in Branford River and Harbor proper, when working, send out 3,000 to 4,000 tons per month, or, estimated, 40,000 tons per year, making a total of 40,120 tons outgoing.

We have never been able to guarantee sufficient water here for regular steamer service for outgoing freight; but we have been assured more than once by steamship companies that such a plan would be considered were the water facilities increased.

The question of draft for vessels is growing more and more upon us, as the tendency is to build not only vessels but the coal barges and boxes larger and requiring deeper water for their safety.

The advantage derived to shippers in sending out freight by water is very great, but of necessity small boats have to be engaged, and to make many more trips than would boats with larger capacity.

Our quarries especially report it very difficult to procure boats to come into the harbor to do their freighting.

Fourth. Factories and business interested in the matter: Two factories employing 1,350 hands; two carriage factories; two lumber and coal wharves; two stone quarries; farming interests that procure feed by boat; oyster business now worked to some extent.

Mr. H. C. Rowe, of New Haven, states that if improvements were made in the harbor facilities he would establish here a branch of his oyster business.

Fifth. Excursion business: Pawson Park, opened to excursion business during the

season, and has averaged 20,000 visitors per season for ten years, coming by boat mostly from New Haven.

As it is, their boats have been subject to very serious delays at times, owing to shallowness of water; and the managers have been obliged to turn away many parties who could come only on large boats, which could not be accommodated in the harbor.

A large number of smaller excursion parties come in on oyster steamers, yachts, and small boats, landing at Double Beach, Branford Point, and Pawson Park.

There is also an excursion business from Branford Center down the river to points both in the harbor and outside along the shore.

Sixth. Shipping: The following boats have been built at Branford shipyards:

	Tons.
Schooner Panther	200
Schooner Steven Hotchkiss	200
Schooner Golden Gate	180
Schooner Eldorado	30
Sloop Wave	30
Steamer Cygnet	10
Sloop Sara Jane	10

According to the last information I had there are at present hailing from Branford six large schooners, one barge steamer, four oyster sloops, a number of smaller oyster boats, aggregating 1,500 to 2,000 tons.

Seventh. From the foregoing it will be seen that the commerce of Branford is extensive and the manufacturing interest in the harbor and river improvements considerable. The natural facilities are such as to attract manufacturers to locate here, which would have been the case in a number of instances if our harbor and river had been in a better condition. The expense incidental to the desired improvements will not be large; the proposed breakwater has already for a foundation a sunken reef which extends over a greater portion of its length, and stone and materials for its construction are close at hand.

Another point which should have some bearing on the matter is the fact that an improvement in our harbor would greatly benefit vessels plying on the sound. Captains who have spent the greater portion of their lives in sound navigation say that in northwesterly and westerly gales it is almost an impossibility for a vessel to make New Haven Harbor, but that she could easily make Branford Harbor, which would in such cases prove a safe and desirable refuge.

Another point I would raise is the fact that the Malleable Iron Fittings Company, employing 750 hands, have large foundries, and are equipped for the making of castings for carriages, caissons, projectiles, etc., if needed in case of war.

Trusting that I have covered all the points necessary for your guidance and report, I remain,

Truly yours,

ALFRED E. HAMMER,
President Branford Board of Trade.

Maj. SMITH S. LEACH,
United States Engineer Office.

APPENDIX F.

IMPROVEMENT OF RIVERS AND HARBORS IN NEW YORK ON LONG ISLAND SOUND AND ON THE SOUTHERN SHORE OF LONG ISLAND; OF HUDSON RIVER AND HARBORS THEREON, OF HARLEM AND EAST RIVERS, NEW YORK, AND OF RIVERS AND HARBORS IN NORTH-EASTERN NEW JERSEY.

REPORT OF COL. S. M. MANSFIELD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Port Chester Harbor, New York. 2. Mamaroneck Harbor, New York. 3. Larchmont Harbor, New York. 4. East Chester Creek, New York. 5. Bronx River, New York. 6. Mattituck Harbor, New York. 7. Port Jefferson Harbor, New York. 8. Huntington Harbor, New York. 9. Glencove Harbor, New York. 10. Flushing Bay, New York. 11. East River and Hell Gate, New York. 12. Harlem River, New York. 13. Newtown Creek, New York. 14. Wallabout Channel, New York. 15. Canarsie Bay, New York. 16. Browns Creek, Sayville, Long Island, New York. 17. Patchogue River, New York. 18. Hudson River, New York. 19. Saugerties Harbor, New York. | <ol style="list-style-type: none"> 20. Rondout Harbor, New York. 21. Peekskill Harbor, New York. 22. Passaic River, New Jersey. 23. Channel between Staten Island and New Jersey. 24. Elizabeth River, New Jersey. 25. Raritan River, New Jersey. 26. South River, New Jersey. 27. Raritan Bay, New Jersey. 28. Matawan Creek, New Jersey. 29. Keyport Harbor, New Jersey. 30. Shoal Harbor and Compton Creek, New Jersey. 31. Shrewsbury River, New Jersey. 32. Manasquan (Squan) River, New Jersey. 33. Removing sunken vessels or craft obstructing or endangering navigation. |
|---|---|

EXAMINATION AND SURVEY.

34. Fire Island Inlet, Great South Bay, and Patchogue River, New York.

HARBOR LINES.

- | | |
|--|--|
| <ol style="list-style-type: none"> 35. Port Chester Harbor and Byram River, New York. 36. Bronx River, New York. 37. Hudson River at Troy, New York. 38. Hudson River from Pleasant Valley Landing to Coytesville, and from Coytesville to Bloomers, New Jersey. | <ol style="list-style-type: none"> 39. Hudson River in the vicinity of Guttenberg, New Jersey. 40. Newark Bay, New Jersey. 41. Arthur Kill, at mouth of Rahway River, New Jersey. 42. Shrewsbury River at Seabright, New Jersey. |
|--|--|

UNITED STATES ENGINEER OFFICE,
New York City, July 11, 1901.

GENERAL: I have the honor to forward herewith annual report upon works of river and harbor improvements in my charge for the fiscal year ending June 30, 1901.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Colonel, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

F I.

IMPROVEMENT OF PORT CHESTER HARBOR, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The present project for this improvement consists in dredging and rock excavation to make a channel 12 feet deep and 70 feet wide from deep water in the bay up to town dock, and thence 9 feet deep and 60 feet wide to the steamboat dock at Port Chester, at an estimated cost of \$25,000.

For maintenance the estimated biennial cost is \$5,000.

At the beginning of the fiscal year work was in progress, under contract with the Newburgh Dredging Company, dated August 29, 1899, for dredging and rock removal. By June 30, 1900, 50,076 cubic yards of mud, sand, and gravel had been removed, and the channel dredged for a length of 4,900 feet. During the present fiscal year work was continued under the contract until October 20, when it expired. The projected channel was completed in accordance with the project, except at the entrance opposite the southerly point of Fox Island, where the width was made but 60 feet on account of the excess of rock excavation over the amount specified in the contract. During that time 27,924 cubic yards of mud, sand, gravel, and bowlders and 713.58 cubic yards of rock were removed, making the total amount of mixed material removed under the contract 78,000 cubic yards, and the total amount of rock 713.58 cubic yards.

This work resulted in a channel 12 feet deep and 70 feet wide from deep water in the bay to the town dock, except opposite Fox Island, where the width is 60 feet, a distance of 2,500 feet, and a channel 60 feet wide, 9 feet deep from the town dock to the steamboat dock, a farther distance of 4,200 feet.

A system of harbor lines was established for this harbor by the Secretary of War on February 18, 1901, and official maps, together with description of the lines, were placed on file in the towns of Port Chester, N. Y., and Greenwich, Conn. This matter was reported upon in detail by Maj. E. H. Ruffner under date of February 13, 1901.

The available funds and the appropriation recommended for fiscal year ending June 30, 1903, will be applied to completing and maintaining the projected channel.

Money statement.

July 1, 1900, balance unexpended	\$17,646.92
June 30, 1901, amount expended during fiscal year	15,506.63
July 1, 1901, balance unexpended	2,140.29
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—

June 10, 1872	\$12,000
August 2, 1882	15,000
August 11, 1888	5,000
September 19, 1890.....	5,000
July 13, 1892.....	5,000
August 18, 1894.....	5,000
June 3, 1896	5,000
March 3, 1899.....	25,000
Total	77,000

CONTRACT IN FORCE DURING YEAR.

Name of contractor: The Newburgh Dredging Company.

Date of contract: August 29, 1899.

Date of approval: September 25, 1899.

Date of commencement: October 25, 1899.

Date of completion: October 24, 1900.

Excavating and removing 78,000 cubic yards, more or less, of mud, sand, gravel, small bowlders, etc., at 18 cents per cubic yard.

Excavating and removing 650 cubic yards, more or less, of ledge rock and bowlders, of one-half yard volume or over, at \$8.80 per cubic yard.

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made.	Tonnage.	Draft.
Steam	1,480	20 to 268	<i>Fect.</i> 4 to 10
Sail.....	100	4 to 600	4 to 13
Barges.....	450	100 to 800	5 to 10

Freight handled.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Fuel.....	40,000	45,000	47,000
Building material	30,000	35,000	37,000
General merchandise	70,000	89,500	97,000
Total	140,000	169,500	181,000

Estimated value of 1900 tonnage, \$7,269,500.

F 2.

IMPROVEMENT OF MAMARONECK HARBOR, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in the removal of Round rock to 4 feet depth, and Bush and inner steamboat rocks to 7 feet depth, and in making a channel 7 feet deep and 100 feet wide from the harbor entrance to the upper wharves, at an estimated cost of \$43,000.

Nothing in furtherance of the project has been done during the fiscal year, owing to the lack of sufficient funds.

The present condition of the improvement is as follows:

Round rock has been removed to a depth of 4 feet, and Bush and inner steamboat rocks to 7 feet depth.

A 7-foot channel from 70 to 90 feet wide extends from the 7-foot curve in the harbor to the upper wharves, a distance of 3,600 feet.

The appropriations recommended for fiscal year ending June 30, 1903, will be applied to widening the channel to 100 feet, in accordance with the project.

Money statement.

July 1, 1900, balance unexpended.....	\$88. 20
July 1, 1901, balance unexpended.....	88. 20

(Amount (estimated) required for completion of existing project.....	11, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	11, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—	
August 2, 1882.....	\$15, 000
June 3, 1896.....	10, 000
March 3, 1899.....	7, 000
Total.....	32, 000

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made	Tonnage.	Draft.
Steam.....	156	54 to 113	<i>Fect.</i> 7 to 8
Sail.....	1	130 to 160	6 to 7
Barges.....	23	250 to 275	6½ to 7½

Freight handled.

Articles.	1896.	1897.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal.....	8,600	11,800	22,583
Building materials.....	12,795	15,873	38,100
General merchandise.....	7,700	24,000	4,002
Total.....	29,095	51,673	64,685

F 3.

IMPROVEMENT OF LARCHMONT HARBOR, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement provides for building a breakwater extending southwardly 1,440 feet from the 6-foot curve off Long Beach point (Flaglers point) and for the removal of Huron rock to a depth of 14 feet at mean low water, at an estimated cost of \$108,000.

At the beginning of the year a contract was in force with the Anderson-Murphy Company, of New York City, for the delivery of 83,000 tons of stone in the breakwater, at 54 cents per ton, but work had not been commenced.

The delivery of stone under this contract commenced July 5, 1900, was continued during the year, and is now nearing completion, the amount of stone placed having been 68,984 tons. The breakwater was completed for a length of 820 feet and partially completed for a farther distance of 500 feet. The dimensions of the completed structure are 5 feet top width, side slopes of 1 on 1 on the inner side and 2 on 3 on the outer side, and height of 10 feet above mean low water.

With the unexpended balance and the appropriations recommended for fiscal year ending June 30, 1903, it is proposed to complete the new breakwater, remove Huron rock and breakwater, and maintain Long Beach point breakwater, after preliminary settling has taken place.

Money statement.

July 1, 1900, balance unexpended.....	\$49,685.35
June 30, 1901, amount expended during fiscal year.....	36,412.28
July 1, 1901, balance unexpended.....	13,273.07
July 1, 1901, outstanding liabilities	4,763.47
July 1, 1901, balance available.....	8,509.60
July 1, 1901, amount covered by uncompleted contracts.....	7,568.64
{ Amount (estimated) required for completion of existing project.....	58,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$58,000.00
For maintenance of improvement	5,000.00
	63,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

1202 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

APPROPRIATIONS.

By act of—	
September 19, 1890	\$5, 000
March 3, 1899	50, 000
Total	55, 000

CONTRACT IN FORCE.

Name of contractor: Anderson-Murphy Company.
Date of contract: June 8, 1900.
Date of approval: June 27, 1900.
Date of commencement: on or before July 27, 1900.
Date of completion: on or before July 31, 1901.
Furnishing and placing 83,000 tons, more or less, of riprap stone for breakwater, at 54 cents per gross ton.

COMMERCIAL STATISTICS.

Commercial statistics for the calendar year 1900 have been asked for but not yet received. Following is a statement of commerce for the year 1898:

Number of vessels other than yachts entering harbor of refuge, or for the night, during 1898 (estimated)	300
Draft of such vessels	feet.. 4 to 12
Tonnage of such vessels	tons.. 10 to 500

Freight discharged in Larchmont Harbor in 1898.

Number of cargoes	75
Amount in tons	4, 500

Vessels owned by the Larchmont Yacht Club.

[Draft, from 3 to 19 feet; tonnage, from 3 to 600 tons; total tonnage, 4,500 tons.]

Steamers	64
Schooners	38
Sloops	95
Smaller boats	104
Total	301

F 4.

IMPROVEMENT OF EAST CHESTER CREEK, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in making a channel 100 feet wide and 9 feet deep at mean high water (about 2 feet at low water), extending from Pelham Bay up the creek 3,000 feet above Lockwoods, and in removing rocky obstructions from the mouth of the creek, at an estimated cost of \$124,000.

An annual appropriation will be required for maintenance.

No work was done during the year owing to lack of funds.

The present condition of the improvement is as follows:

The project is considered completed, a channel about 100 feet wide and 9 feet deep, at mean high water, having been made from Pelham Bridge to a point 3,000 feet above Lockwoods. It is in fair condition.

The dikes on the east side of the cut below Lockwoods, built in 1877-78, show some deterioration. No repair is necessary at present.

The appropriation asked for fiscal year ending June 30, 1903, will be used for maintenance of improvement.

Money statement.

July 1, 1900, balance unexpended	\$197. 53
July 1, 1901, balance unexpended	197. 53
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1873	\$25, 000	August 11, 1888.....	\$5, 000
March 3, 1875	12, 000	August 18, 1894.....	12, 000
June 18, 1878.....	10, 000	June 3, 1896.....	10, 000
March 3, 1879	3, 500		
June 14, 1880.....	3, 500	Total	91, 000
August 5, 1886.....	10, 000		

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made.	Tonnage.	Draft.
Steam	8		<i>Feet.</i> 10 to 12
Sail	6	200 to 800	8
Barges.....	254		4 to 8

Freight handled.

Articles.	1896.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	16, 878	39, 980	54, 175
Building material	7, 580	84, 388	47, 500
General merchandise.....	70, 470	162, 060	198, 800
Total	94, 928	286, 428	300, 475

F 5.

IMPROVEMENT OF BRONX RIVER, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in making a channel 4 feet deep and 100 feet wide at and near the mouth; thence 60 feet wide to Dongan street, about half way to West Farms; thence 50 feet

wide to the head of navigation at West Farms, at an estimated cost of \$85,985.

At the beginning of the fiscal year work was in progress under a contract with Samuel F. Randolph, dated October 12, 1899, and was continued until April 19, 1901, when the contract expired. The amount of rock removed during that time was 2,630 cubic yards, which, added to the 667 cubic yards removed last year, makes a total of 3,297 cubic yards removed under the contract. The rock was taken from thirteen ledges at various points in the river, within the limits of the projected 50-foot channel above Dongan street, mostly in the vicinity of Westchester avenue, and from a reef of rocks and bowlders near the head of navigation.

The available funds and the appropriation recommended for fiscal year ending June 30, 1903, will be applied to removing rock obstructions and other material in the 50-foot channel, near the railroad bridge, and in dredging, beginning at the lower end of the river.

Money statement.

July 1, 1900, balance unexpended	\$15,888.58
June 30, 1901, amount expended during fiscal year	12,068.66
July 1, 1901, balance unexpended	3,819.92
{ Amount (estimated) required for completion of existing project	55,985.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	30,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—	
June 3, 1896	\$10,000
March 3, 1899	20,000
Total	30,000

CONTRACT IN FORCE DURING THE YEAR.

Name of contractor: Samuel F. Randolph.

Date of contract: October 12, 1899.

Date of approval: October 24, 1899.

Date of commencement: November 14, 1899.

Date of completion: June 30, 1901.

Removal of 3,000 cubic yards of rock at \$3.78 per cubic yard.

COMMERCIAL STATISTICS.

Articles.	1897.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	65,500	75,800	103,000
Lumber	5,700	3,000	3,500
Building material	54,380	62,500	45,000
Ice	12,000	15,000	.....
General merchandise	1,730	15,000	15,000
Total	139,310	171,300	166,500

The above freight is carried in steamers, sailing vessels, and barges having a tonnage of from 85 to 300 tons and a draft of from 4 to 6 feet.

F 6.

IMPROVEMENT OF MATTITUCK HARBOR, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement provides for a channel 7 feet deep at mean low water from the entrance to the dam, and 7 feet deep mean high water above the dam to the village, the width to be 80 feet except at the mouth, where it is increased to 100 feet, the entrance channel to be protected by parallel jetties; estimated cost of work, \$83,000.

The work carried on during the year consisted in the partial construction of the west jetty, at the channel entrance, under a contract entered into with Eugene S. Belden for the delivery of about 8,800 gross tons of riprap at a cost of \$1.47 per ton.

The delivery of stone began August 23, 1900, and was completed July 2, 1901, and the contract closed.

The total amount of stone delivered was 8,781 gross tons, which sufficed to build the west jetty to the 10-foot contour in the Sound, a distance of 680 feet. The jetty rises to a height of 4 feet above high water except at the outer end, where the height was increased to 6 feet to make it more conspicuous, thereby serving to some extent as an entrance mark. The top width is about 4 feet and the side slopes 1 on 1.

The available balance and the appropriation recommended for fiscal year ending June 30, 1903, will be applied to jetty construction and dredging.

Money statement.

July 1, 1900, balance unexpended	\$15,000.00
June 30, 1901, amount expended during fiscal year.....	10,129.08
July 1, 1901, balance unexpended	4,870.92
July 1, 1901, outstanding liabilities.....	4,140.87
July 1, 1901, balance available	730.05
July 1, 1901, amount covered by uncompleted contracts.....	421.89
{ Amount (estimated) required for completion of existing project.....	68,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—	
June 3, 1896	\$10,000
March 3, 1899.....	5,000
Total	15,000

CONTRACT IN FORCE DURING YEAR.

Name of contractor: Eugene S. Belden.

Date of contract: August 18, 1900.

Date of approval: August 28, 1900.

Date of commencement: September 19, 1900.

Date of completion: July 18, 1901.

Furnishing in place in jetty, about 8,800 gross tons of riprap stone, at \$1.47 per gross ton.

COMMERCIAL STATISTICS.

No statement of amount of tonnage of freights by water has been received. The harbor in its present condition is navigated only by boats of very light draft, and even this is done with difficulty.

The greater part of the freighting to and from Mattituck, estimated at about 100,000 in 1896, is done by rail.

F 7.

IMPROVEMENT OF PORT JEFFERSON HARBOR, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The present project for this improvement consists in dredging a channel, 12 feet deep and 200 feet wide, through the harbor entrance, and in protecting it by extending and enlarging the previously built jetties at an estimated cost of \$145,000.

At the beginning of the fiscal year work was in progress on the jetties under a contract with the Hudson Contracting Company, dated October 7, 1899, and was continued until July 2, 1900, when the contract expired.

The work of the year consisted in placing 538.1 tons of riprap stone in the outer end of the east jetty for the purpose of protecting the foundation of a light-house built there and which had been damaged through a settlement in the jetty.

The total amount of stone delivered under the contract was 7,790.9 tons, of which 5,480 tons were placed in the west jetty and 2,310.9 tons in the east jetty.

The enlargement of the west jetty for a length of 876 feet out from the high-water line on shore was completed. The outer end for a length of 60 feet was built up to a height of 6 feet above average high-water line. The rest of the work was made 4 feet above mean high water and 4 feet wide on top. The east jetty was widened and raised for a total length of 163 feet north and south of the light-house, which is near the outer end of the jetty.

The condition of the improvement on June 30, 1901, remains about the same as described in the Report of the Chief of Engineers for 1900, page 1395, except that the channel has shoaled in places 2 feet.

The available balance and the appropriation recommended for the fiscal year ending June 30, 1903, will be expended in enlarging the east jetty and in dredging the channel to its projected dimensions.

Money statement.

July 1, 1900, balance unexpended	\$4, 395. 75
June 30, 1901, amount expended during fiscal year	4, 008. 43
July 1, 1901, balance unexpended	387. 32
{ Amount (estimated) required for completion of existing project	87, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30,	
1903, in addition to the balance unexpended July 1, 1901	24, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

APPROPRIATIONS.

By act of--	
March 3, 1871	\$15, 000
June 10, 1872	15, 000
March 3, 1875	15, 000
August 14, 1876	6, 000
June 18, 1878	8, 000
March 3, 1879	5, 000
June 14, 1880	3, 000
March 3, 1881	4, 000
August 2, 1882	8, 000
	\$79, 000
September 19, 1890	25, 000
July 13, 1892	10, 000
August 18, 1894	7, 500
June 3, 1896	7, 500
March 3, 1899	7, 500
	57, 500
Total	136, 500

CONTRACT IN FORCE DURING THE FISCAL YEAR.

Name of contractor: The Hudson Contracting Company.

Date of contract: October 7, 1899.

Date of approval: October 24, 1899.

Date of commencement: November 14, 1899.

Date of completion: May 13, 1900.

Furnishing and placing in jetties 7,800 gross tons of riprap stone, at 89 cents per ton.

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made.	Tonnage.	Draft.
Steam	1, 742	10 to 1, 000	<i>Fect.</i> 3 to 15
Sail	2, 016	15 to 1, 500	3 to 14
Barges	46	100 to 500	6 to 10

Freight handled.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	7,240	5,700	6,000
Grain	9,800	2,700	3,000
Building material	900	8,050	8,100
General merchandise	7,000	25,680	23,280
Total	24,940	42,130	40,380

F 8.

IMPROVEMENT OF HUNTINGTON HARBOR, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The present project for this improvement consists in making a channel 100 feet wide and 8 feet deep to the docks at Huntington, at an estimated cost of \$32,000.

Nothing was done during the fiscal year, no funds being available.

The present condition of the improvement is as follows:

The dredged channel has been made 8 feet deep and 200 feet wide from the entrance bend below Ketchum's dock to the bend at the old town dock, a length of 3,700 feet, and 150 feet wide for a length of 300 feet in front of docks above the old town dock, the width over 100 feet being made for purpose of maintenance without diking.

The appropriations recommended for fiscal year ending June 30, 1903, are to be applied to completing and maintaining the channels by means of dredging.

Money statement.

July 1, 1900, balance unexpended	\$10. 94
July 1, 1901, balance unexpended	10. 94
{ Amount (estimated) required for completion of existing project	2,500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$2,500. 00
For maintenance of improvement	2,500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000. 00

APPROPRIATIONS.

By act of—		By act of—	
June 10, 1872	\$22,500	June 3, 1896	\$5,000
September 19, 1890	10,000	March 3, 1899	7,500
July 13, 1892	5,000		
August 18, 1894	2,000	Total	52,000

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made.	Tonnage.	Draft.
Steam	600	125 to 250	<i>Fect.</i> 6 to 8
Sail	150	50 to 250	5 to 12
Barges	75	200	5 to 6½

Freight handled.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	5,500	8,000	8,000
Building material	5,317	19,000	18,000
Grain	767	2,000	2,000
General merchandise	12,000	17,500	17,600
Total	23,584	46,500	45,600

The value of the merchandise carried during 1900 was \$768,000.

F 9.

IMPROVEMENT OF GLENCOVE HARBOR, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in constructing a breakwater 2,000 feet long in Hempstead Harbor, from the northwest corner of Glencove dock west-southwestwardly toward Motts Point, so as to shelter the anchorage outside Glencove Harbor. Estimated cost of the work, \$135,000.

Nothing was done during the fiscal year owing to lack of funds.

The present condition of the improvement is as follows:

The breakwater is now 1,465 feet long, with 3 feet top width at a level of 4 feet above mean high water, and affords a shelter to vessels waiting for tide to enter Glencove Harbor, also to local commerce at Glencove dock.

The project is about one-half completed.

The appropriations recommended for fiscal year ending June 30, 1903, will be applied to completing the breakwater in accordance with the project.

Money statement.

{ Amount (estimated) required for completion of existing project	\$72,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903.	10,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

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APPROPRIATIONS.

By act of—

August 11, 1888	\$20,000
September 19, 1890	15,000
July 13, 1892	10,000
August 18, 1894	10,000
June 3, 1896	8,000
Total	63,000

COMMERCIAL STATISTICS.

A statement of the commerce for the calendar year 1900 was asked for, but was not received.

The last reliable information received regarding the commerce of this harbor was for the year 1897. It was as follows:

Freight handled.

Articles.	1897.
	<i>Tons.</i>
Coal	15,000
Grain	50,400
Building material	150,000
General merchandise	518,000
Total	733,400

This freight was carried in steamers, sailing vessels, and barges having a tonnage of from 20 to 330 tons and drawing from $4\frac{1}{2}$ to $7\frac{1}{2}$ feet. Aggregate tonnage for the year was 400,755 tons. Total number of round trips was 2,654.

F 10.

IMPROVEMENT OF FLUSHING BAY, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in building a dike 4,663 feet long on the west side of the channel, to protect it from filling, and in making and maintaining a channel 6 feet deep from deep water in the bay up to the lower bridge at Flushing, at an estimated cost of \$173,500.

No work was done during the fiscal year on account of lack of funds.

The present condition of the improvement is as follows:

The dike, 4,663 feet long, is in poor condition. The outer part, 1,606 feet long, which was left partly completed in 1891, has since been nearly destroyed by storms and ice. Further work upon the dike being discontinued, owing to the strong opposition of property owners along the shores of the bay (see Annual Report of the Chief of Engineers for 1892, p. 723), it is not proposed to repair the structure.

When work was last suspended, in May, 1897, the channel leading to Flushing had an available depth of 6 feet or more and was in good condition. The projected width has not been obtained.

No shoaling has been reported during the year.

The appropriations recommended for fiscal year ending June 30, 1903, are to be applied to maintaining and widening the dredged channel.

Money statement.

July 1, 1900, balance unexpended	\$504.47
July 1, 1901, balance unexpended	504.47
Amount (estimated) required for completion of existing project	50,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$20,000.00
For maintenance of improvement.....	5,000.00
	25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1879.....	\$20,000	September 19, 1890.....	\$20,000
June 14, 1880.....	15,000	July 13, 1892.....	10,000
March 3, 1881.....	10,000	August 18, 1894.....	4,000
August 2, 1882.....	5,000	June 3, 1896.....	4,000
July 5, 1884.....	10,000		
August 5, 1886.....	10,000	Total	123,000
August 11, 1888.....	15,000		

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made.	Tonnage.	Draft.
Steam	1,541	100 to 156	<i>Feet.</i> 7 to 7½
Sail.....	200	150 to 450	6 to 14
Barges.....	405	100 to 700	6 to 10

Freight handled.

Articles.	1897.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal.....	32,109	33,700	37,070
Building materials.....	12,670	12,670	14,570
Paving materials.....	73,566	66,210	76,143
General merchandise.....	45,050	46,175	49,792
Total	163,395	158,755	177,575

F II.

IMPROVEMENT OF EAST RIVER AND HELL GATE, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20, to May 3, 1901.]

The present project for this improvement consists in the removal of rocks and reefs obstructing the channel in Hell Gate and East River so

as to afford depths of from 18 to 26 feet, and in the construction of sea walls and dikes where necessary to guide the tidal currents. The estimated cost of the work was \$5,639,120.

Work was continued during the year on the removal of Man-o'-War rock under a contract entered into with the R. G. Packard Company, with the following results:

About three-quarters of the rock area has been drilled and blasted, and 8,481 cubic yards of rock taken out, or about 44 per cent of the estimated volume to be removed under the project.

The removal of the reefs off Third and Twenty-sixth streets was commenced under a contract entered into with George A. Rogers. Work began on the Third street reef, but was suspended January 15, 1901, without any rock having been taken out, as it was found impossible to dredge blasted rock with an ordinary scoop dredge. On resumption of work, April 18, the plant was placed on the Twenty-sixth street reef, where operations were continued until the close of the year, during which time only 68.9 cubic yards of rock was removed.

For the removal of rocks and bowlders from Battery and Shell reefs, a contract was entered into with the R. G. Packard Company. Work began December 11, 1900, and was continued until May 31, 1901, when contract was completed. The total amount of material removed was 19,743 tons, of which 12,728 tons was taken from Battery reef and 7,015 tons from Shell reef and vicinity.

The depths made on Battery reef were from 22 to 26 feet, the previous ones having been from 17 to 26 feet, and on Shell reef 17 to 18 feet, the previous ones having been from 11 to 14 feet.

This work was urgently demanded for the safety of vessels crossing, or being forced upon, Battery reef and Shell reef. Extensive damage was done to several ships which struck these reefs during the past two years.

The plant laid up at Mill rock was cared for.

The present and proposed condition of the improvement is exhibited in the following table:

Localities.	Least original depth.	Least present depth.	Proposed depth.
	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Part of Battery reef	17	19 to 26	26
Rocky obstructions off South Ferry slips.....	17	19 to 26	26
Diamond reef	17	26	24
Reef off Diamond reef.....	19	26	26
Coenties reef	14.3	25.5	24
Rock off Third street	15.9	15.9	19
Shell reef, off Ninth Street, and vicinity	7.5	15	18
Pilgrim rock, off Nineteenth street.....	12	24	24
Rock off Twenty-sixth street	16.1	16.1	26
Ferry reef, off Thirty-fourth street	7	24	26
Charlotte rock, off Thirty-fourth street.....	14.7	26.5	26
Man-o'-War rock	.8	.8	26
Middle reef, including Flood rock Gridiron, Hen and Chickens, and Negro Heads	6	18 to 20	26
Hallets Point	4	26	26
Heel Tap	12.1	20.5	26
Frying Pan	11	18	26
Pot rock	20	22.8	26
Way reef	17.4	26	26
Shell Drake	18.3	26	26
Scaly rock		26	26
Negro Point			26
Reef off Sunken Meadow	11	17.8	18
North Brother Island reef.....	16	26	26
Reef off Baretto Point.....	17	24	24

The work which remains to be done to complete the present project, not including work now under contract, is as follows:

Name of locality.	Present depth, low water.	Projected depth, low water.
	<i>Feet.</i>	<i>Feet.</i>
Shell reef, off Ninth street, and reef between Broome street and Twenty-third street	15	18
Ferry reef	24	26
Middle reef	18 to 20	26
Heel Tap	20.5	26
Frying Pan	18	26
Pot rock	22.8	26
Negro Point		26
Reef off Sunken Meadow	17.8	18
Battery reef	19	26

With the available funds it is proposed to finish the removal of Man-o'-War rock to a depth of 26 feet, and reefs off Third street and Twenty-sixth street to 19 and 26 feet, respectively. The appropriation recommended for fiscal year ending June 30, 1903, will be expended in removing rocks included in the project, doing first the work most urgently needed.

Money statement.

July 1, 1900, balance unexpended	\$239,375.82
June 30, 1901, amount expended during fiscal year	96,902.83
July 1, 1901, balance unexpended	142,472.99
July 1, 1901, outstanding liabilities	35,503.20
July 1, 1901, balance available	106,969.79
July 1, 1901, amount covered by uncompleted contracts	99,904.13
{ Amount (estimated) required for completion of existing project	1,003,840.67
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	300,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—

July 25, 1868	\$85,000.00
April 10, 1869	178,300.00
July 11, 1870	250,000.00
March 3, 1871	250,000.00
June 10, 1872	225,000.00
March 3, 1873	225,000.00
June 23, 1874	225,000.00
March 3, 1875	250,000.00
August 14, 1876	250,000.00
June 18, 1878	350,000.00
March 3, 1879	250,000.00
June 14, 1880	200,000.00
March 3, 1881	200,000.00
May 4, 1882	50,000.00
August 2, 1882	200,000.00
July 5, 1884	360,000.00
August 5, 1886	112,500.00
August 11, 1888	250,000.00
September 19, 1890	200,000.00

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Act of—

July 13, 1892.....	\$150,000.00	
August 18, 1894.....	75,000.00	
June 3, 1896.....	60,000.00	
March 3, 1899.....	250,000.00	
Net receipts from other sources.....	3,637.88	
Total.....		4,649,437.88
Deduct amount reverted to United States Treasury.....	\$3,158.55	
Deduct amount allotted to Harlem River.....	11,000.00	
		14,158.55
		4,635,279.33

CONTRACTS IN FORCE DURING YEAR.

Name of contractor: R. G. Packard Company.

Date of contract: June 21, 1899.

Date of approval: July 13, 1899.

Date of commencement: On or before September 11, 1899.

Date of completion: On or before December 26, 1901.

Excavation and removal of Man-o'-War rock to a depth of 26 feet below mean low water, for the lump sum of \$159,000.

Name of contractor: George A. Rogers.

Date of contract: September 3, 1900.

Date of approval: September 12, 1900.

Date of commencement: On or before November 14, 1900.

Date of completion: On or before October 13, 1901.

Excavation and removal of reef off Twenty-sixth street and reef off Third street, aggregating 1,001 cubic yards, at \$12.87 per cubic yard.

Name of contractor: R. G. Packard Company.

Date of contract: November 15, 1900.

Date of approval: November 27, 1900.

Date of commencement: On or before January 27, 1901.

Date of completion: On or before July 1, 1901.

Removal of rocks and boulders to a depth of 26 feet below mean low water, at \$2.65 per gross ton.

Work was commenced on December 11, 1900, and completed May 31, 1901.

COMMERCIAL STATISTICS.

The commerce of the East River is so intimately connected with that belonging to New York Harbor proper that it is impracticable to make a separate statement of it.

F 12.

IMPROVEMENT OF HARLEM RIVER, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement provides for a channel from the Hudson River to the East River, 400 feet wide and 15 feet deep, except in the rock cut through Dyckman Meadow, where the channel is to be 350 feet wide and 18 feet deep, and north of High Bridge where the width is to be reduced to 375 feet; at an estimated cost of \$2,700,000.

At the beginning of the fiscal year a proposition for the relief of the United States from all obligations in regard to the stone stored on the Dyckman estate by the payment of \$75,000 was under consideration, and work under a contract with P. Sanford Ross, Incorporated,

dated December 11, 1899, for dredging at and near the mouth of the Spuyten Duyvil Creek had been suspended on June 4, 1900, pending the completion of the new railroad bridge. Under this contract 132,174 cubic yards of mud had been removed.

On August 26, 1900, payment of \$75,000 was made to the estate of I. M. Dyckman, releasing the United States from all obligations to remove the stone stored on land leased from said estate near Spuyten Duyvil. The lease for the land was then terminated.

In August, 1900, an examination was made of the section of the river from a point 1,000 feet above the Madison Avenue Bridge to a point about 500 feet south of Willis Avenue Bridge.

Under contract of P. Sanford Ross, Incorporated, which was extended, dredging was resumed on November 21, suspended December 4, 1900, resumed March 15, and completed March 20, 1901.

The amount of material dredged in the fiscal year was 12,950 cubic yards, and the total amount under the contract was 145,124 cubic yards. The delays on this contract were entirely due to the fact that it could not be completed until work upon the new bridge, and removal of the temporary bridge, was finished.

The result of this dredging is the opening of the river near its mouth to give it nearly its full width of 400 feet, and over most of its area a depth of 15 feet or over at mean low water. The new bridge has two draw openings of 100 feet each. The plant laid up at Mill Rock was cared for.

The present condition of the improvement is as follows:

From the Hudson River to Macombs Dam Bridge the improved channel is 12 feet deep and over at mean low water, and from 180 to 350 feet wide; at and near the Hudson River it is 400 feet wide, and about 15 feet deep. The cut through Dyckman Meadow, originally excavated to a depth of 18 feet, mean low water, has shoaled to 15 feet in some places owing to the deposit of silt; the width of the cut is 350 feet. From Macombs Dam Bridge south to Wards Island, East River, the available channel is 15 feet deep and over and nowhere less than 150 feet wide.

To complete the project there remains the widening of the channel to the full width of 350 to 400 feet, deepening it to 15 feet where that depth has not already been obtained, and revetting the banks where the channel excavation passes through meadow or upland.

The available funds and the appropriation recommended for fiscal year ending June 30, 1903, will be applied to widening and deepening the channel by dredging, and in constructing bank revetment, if deemed necessary, in accordance with the approved project.

Money statement.

July 1, 1900, balance unexpended	\$84,037.31
June 30, 1901, amount expended during fiscal year	80,697.67
July 1, 1901, balance unexpended	3,339.64
July 1, 1901, outstanding liabilities	180.00
July 1, 1901, balance available	3,159.64
{ Amount (estimated) required for completion of existing project	1,455,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	500,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

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APPROPRIATIONS.

By act of—

June 23, 1874, allotment.....	\$11,000	
March 13, 1875.....	10,000	
		\$21,000
June 18, 1878	300,000	
March 3, 1879.....	100,000	
August 11, 1888	70,000	
September 19, 1890.....	250,000	
July 13, 1892.....	175,000	
August 18, 1894	125,000	
June 3, 1896.....	125,000	
March 3, 1899.....	100,000	
		1,245,000
Total		1,266,000

CONTRACT IN FORCE DURING THE YEAR.

Name of contractor: P. Sanford Ross, incorporated.

Date of contract: December 11, 1899.

Date of approval: December 26, 1899.

Date of commencement: March 20, 1900.

Date of completion: July 19, 1900. Extended to April 15, 1901.

Dredging 150,000 cubic yards, more or less, of material, at 10.4 cents per cubic yard, measured in scows.

COMMERCIAL STATISTICS.

The commerce of the Harlem River is so intimately connected with that belonging to East River and New York Harbor that it is impracticable to make a separate statement of it, as no record is kept. During the years 1893 and 1895 a general statement of the commerce was obtained from data collected by the employees of this office engaged on the improvement. Since the latter date it has been impracticable to attempt a collection of statistics by the method referred to. The commerce of 1893 and 1895 was as follows:

Items.	1893.	1895.
	<i>Tons.</i>	<i>Tons.</i>
General merchandise.....	3,232,052	3,473,581
Grain, flour, feed, etc.....	596,306	767,851
Lumber and timber	451,702	633,194
Building material	602,217	1,526,043
Fuel.....	878,234	947,710
Ice.....	149,865	185,215
Total	5,910,376	7,533,594

F 13.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in making a channel 125 feet wide and 18 feet deep from the mouth of Newtown Creek to the head of navigation at Metropolitan avenue, at an estimated cost of \$450,000; an annual appropriation will be required for maintenance.

The projected channel having been practically completed, nothing was done during the year, no maintenance work having been required.

The present condition of the improvement remains about the same as described on page 1411 of the Annual Report of the Chief of Engineers for 1900.

The available funds and the appropriation recommended for fiscal year ending June 30, 1903, will be applied to maintenance of the dredged channel.

Money statement.

July 1, 1900, balance unexpended.....	\$15,685.61
July 1, 1901, balance unexpended.....	15,685.61
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—	
June 14, 1880	\$10,000
August 2, 1882	15,000
July 5, 1884	20,000
August 5, 1886	37,500
August 11, 1888	25,000
September 19, 1890	35,000
July 13, 1892	35,000
August 18, 1894	20,000
	\$197,500
June 3, 1896	30,000
June 4, 1897	183,000
	213,000
Total	
	410,500

COMMERCIAL STATISTICS.

It was not practicable to obtain reliable statistics for the calendar year 1900. The following statement, carefully compiled for the year 1897, is believed to represent fairly the annual commerce of the stream:

Freights received and shipped by water.

	Tons.	Estimated value.
Received.....	2,402,551	\$29,596,218
Shipped.....	825,993	21,850,713
Total.....	3,228,544	51,446,931

This freight consists of coal, lumber, building materials, petroleum products, chemicals, and miscellaneous goods.

In addition there were about 420,000 tons of cellar excavations and street cleanings received for filling low lands.

Vessels engaged in above commerce.

	Number.	Draft loaded.	Tonnage.
		<i>Feet.</i>	
Steamers (tugs not included).....	1,068	6 to 19	120 to 2,250
Sailing vessels.....	1,768	6 to 19	50 to 3,200
Barges, etc.....	12,628	6 to 12	100 to 600
Total.....	15,464		

F 14.**IMPROVEMENT OF WALLABOUT CHANNEL, NEW YORK.**

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consisted in making the eastern part of Wallabout Channel 20 feet deep, with widths of from 230 to 350 feet.

The work required to be done to carry out this project was completed in January, 1900.

For details see Annual Report of Chief of Engineers for 1900, page 1414.

In accordance with the recommendation of Maj. E. H. Ruffner, dated August 14, 1900, a balance of \$21,826.31, not required under the approved project, was returned to the Treasury of the United States.

F 15.**IMPROVEMENT OF CANARSIE BAY, NEW YORK.**

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in securing a channel, 100 to 150 feet wide and 6 feet deep, from Big Channel, Jamaica Bay to Canarsie dock, by dredging and dike construction; in dredging a branch channel, 4 feet deep and about 50 feet wide, from Canarsie Landing to Island Channel; also in dredging a channel, 5 feet deep and 50 feet wide, from Canarsie Landing to Gophel Channel, all at an estimated cost of \$88,000.

Sufficient funds were not available, and therefore no work was done during the fiscal year.

The condition of the improvement remains about the same as that given on page 1416 of the Report of the Chief of Engineers for 1900.

Money statement.

July 1, 1900, balance unexpended	\$524. 92
June 30, 1901, amount expended during fiscal year	2. 00
July 1, 1901, balance unexpended	522. 92
Amount (estimated) required for completion of existing project	23, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$15, 000. 00
For maintenance of improvement	5, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20, 000. 00

APPROPRIATIONS.

By act of—		By act of—	
June 14, 1880	\$10, 000	September 19, 1890	\$5, 000
March 3, 1881	5, 000	July 13, 1892	5, 000
August 2, 1882	3, 000	August 18, 1894	2, 000
July 5, 1884	5, 000	June 3, 1896	10, 000
August 5, 1886	10, 000		
August 11, 1888	10, 000	Total	65, 000

COMMERCIAL STATISTICS.

A statement of commerce for the year 1900 has been asked for, but was not received.

For the year 1896 the tonnage amounted to 50,087 tons of freight, valued at \$427,375. No reliable reports have been received since then.

F 16.**IMPROVEMENT OF BROWNS CREEK, SAYVILLE, LONG ISLAND, NEW YORK.**

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement consists in widening and deepening the creek up to the highway bridge, a distance of 6,300 feet, making it 100 feet wide and 4 feet deep a distance of 4,800 feet above the entrance, and 2 feet deeper at the entrance, for a distance of 1,500 feet, and in protecting the entrance channel by jetties on either side, the west jetty to be 1,600 feet long and the east jetty 1,400 feet long, at an estimated cost of \$46,000.

Nothing in furtherance of the project has been done during the fiscal year.

The condition of the improvement remains about the same as that given in the Report of the Chief of Engineers for 1900, page 1417.

The available funds and the appropriations recommended for fiscal year ending June 30, 1903, will be expended in completing and maintaining the channel by dredging.

Money statement.

July 1, 1900, balance unexpended	\$463. 45
July 1, 1901, balance unexpended	463. 45
{ Amount (estimated) required for completion of existing project	18,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$18,000. 00
For maintenance of improvement	2,500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,500. 00

APPROPRIATIONS.

By act of—	
September 19, 1890	\$12,000
July 13, 1892	5,000
August 18, 1894	4,000
June 3, 1896	4,000
March 3, 1899	3,000
Total	28,000

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made.	Tonnage.	Draft.
			<i>Feet.</i>
Steam	4	10 to 15	3 to 5
Sail	210	2½ to 60	2 to 6
Barges	15	5 to 20	1 to 2

Freight handled.

Class.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Building material	2,500	2,500	2,000
Fish	10	512	512
Shellfish	8,190	8,630	9,760
Total	10,700	11,642	12,272

F 17.

IMPROVEMENT OF PATCHOGUE RIVER, NEW YORK.

[This work was in the charge of Maj. E. H. Ruffner, Corps of Engineers, to April 20, 1901, and of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), from April 20 to May 3, 1901.]

The project for this improvement proposed dredging a channel, 60 feet wide and 6 feet deep, from Great South Bay to the head of navigation, a distance of about 1 mile, and protecting the entrance channel from westerly storms by a jetty 1,700 feet long, at a total estimated cost of \$40,000. This project has been completed, so that future operations will consist only in maintenance.

No work was done during the year, none having been considered necessary.

The appropriation recommended for fiscal year ending June 30, 1903, will be applied to maintenance.

The emergency river and harbor act of June 6, 1900, provided for an examination and survey of Fire Island Inlet, in Great South Bay, to Patchogue River, with a view to obtaining a channel not less than 10 feet in depth and 200 feet in width, report upon which was published in House Document No. 103, Fifty-sixth Congress, second session.

Money statement.

July 1, 1900, balance unexpended	\$706. 85
July 1, 1901, balance unexpended	706. 85

{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvements, in addition to the balance unexpended July 1, 1901	5,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—	
September 19, 1890	\$15,000
July 13, 1892	8,000
August 18, 1894	4,000
June 3, 1896	13,000
Total	40,000

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Trips made.	Tonnage.	Draft.
			<i>Feet.</i>
Steam	1,400	20 to 70	3 to 5
Sail	7,700	8 to 300	3 to 8
Barges	4,700	30 to 80	2 to 5

Freight handled.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	13,000	13,500	14,000
Lumber	203,000	213,500	219,000
Fish and shellfish	5,200	5,300	5,500
General merchandise	34,000	34,500	35,600
Total	255,200	266,800	274,100

The estimated value of the 1900 tonnage was \$3,919,000.

F 18.

IMPROVEMENT OF HUDSON RIVER, NEW YORK.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to May 3, 1901.]

The portion of this river now under improvement by the United States extends from the State dam at Troy downstream to Coxsackie. The object is to provide navigation with a 12-foot channel 150 feet wide from the State dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. Below this latter point there is ample depth and width of channel.

At the beginning of the present year dredging, rock removal, and dike construction and repair was in progress under contracts of Kirk, Driscoll & Co., and James Du Bois, and was continued throughout the year with the exception of the winter months.

Dredging for the relief of navigation and in continuance of the project was carried on between Castleton and Troy, the following quantities of material having been removed from the localities named and the spoil disposed of according to law, viz:

	Cubic yards.
Nine Mile Tree cross-over.....	2, 013
Castleton bar	54, 148
Stone Light shoal.....	12, 125
Bogart Light shoal.....	12, 951
In front of Albany.....	5, 822
Bath shoal.....	83, 880
In front of arsenal.....	16, 548
Arsenal to Congress street.....	38, 174
Congress street to Broadway	29, 327
Broadway to D. & H. Co.'s bridge.....	106, 622
D. & H. Co.'s bridge to State dam.....	32, 593
Total	394, 203

The removal of rock was carried on between Broadway and Adams street, Troy, and good progress was made, except close to the wharves, where, in order to avoid the probability of damage to the adjacent property, no blasting was done nearer than 15 feet, pending the furnishing of indemnity bonds by the riparian owners.

The following is a statement of the area of rock reduced to the required depth below the mean low-water plane, and the prism measurement of rock removed, viz:

Name of reef.	Area dredged.	Prism removed.
	<i>Sq. ft.</i>	<i>Cu. yds.</i>
Adams Street	21, 350	1, 259
Washington Street.....	35, 650	1, 448
Congress Street	81, 430	6, 184
Broadway	55, 915	4, 684
Total.....	194, 345	13, 575

The progress in the construction and repair of dikes was not as satisfactory as might have been expected during the extremely dry weather of last summer and fall, which was in every way favorable for this kind

of work. During the spring season the river has been constantly at freshet height, thereby delaying the work.

The following table gives the total quantities of materials used during the year in the construction and repair of dikes, viz:

Pine piling	linear feet ..	57,360
Sheet piling	feet B. M. ..	29,616
Round timber	linear feet ..	1,117
Square timber	feet B. M. ..	48,672
Tie-rods and screw bolts	pounds ..	37,163
Driftbolts and washers	do.	8,359
Rubblestone	cubic yards ..	6,565
Paving stone	do.	108

An extension of the Mulls Plaat dike for a distance of 2,500 feet was the only construction of new dikes undertaken. The piling has all been driven and sawed off, and a portion of the waling timber has been placed.

Repairs to existing dikes were made at the following localities, either by partially or wholly renewing piling and timber along the channel face, with substantial anchorage and rubblestone filling, viz:

Name of dike.	Character of work.	State of work.	Length of dike repaired.	Cost of repairs per linear foot.
Coxsackie Island	Full repairs		<i>Lin. feet.</i> 30	\$1.65
Barren Island	do.	In progress ..	500	
Roah Hook	do.		840	1.70
Do.	New waling and rubble		330	.40
Bogart Island	Full repairs	In progress ..		
Small Island	Sheet piling channel face	do.		
Cuyler	Full repairs	do.	2,788	

Paving and rubble stone was also used in repairing the paving and protecting footing of old dikes and revetments and in refilling old pile dikes at the following localities, viz:

Name of dike.	Paving stone.	Rubble-stone.	Length of footing protected.	Length of dike re-filled.	Cost of materials.
	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Lin. feet.</i>	<i>Linear feet.</i>	
Coxsackie Island		263		800	\$210.40
Light-house Island		232		1,000	185.60
Bronks Island		512		1,500	409.60
Houghtailing Island		35		600	28.00
New (New York State)		320		1,000	256.00
New Baltimore West		417		2,100	333.60
Coeymans North		426		1,400	340.80
Roah Hook		50		130	40.00
Shad Island		150		460	120.00
Upper Schodack Island Half		385		1,721	308.00
Schermerhorn Island		591		2,117	472.80
Cedar Hill		506		2,000	404.80
Overslaugh No. 2		219	500		175.20
Beacon Island Half		179		185	157.96
Base Island	108	25	150		160.40
Hillhouse Island revetment		70	150		56.00
Breaker Island Half		83		900	66.40
Breaker Island revetment		70	200		56.00

The season of 1900 was excessively dry, and there were several very low tides occasioned by strong northwesterly winds, but the results of tidal observations kept during the whole period of navigation at Albany and from August 4 to November 27 at Troy do not differ

from those of the previous season. The highest natural tide at Albany and opposite Broadway, Troy, was, respectively, 3.68 feet and 3.58 feet above the plane of reference, and the lowest tide at the same stations was 1.96 feet and 2.63 feet below the plane of reference. For the previous results of tidal records reference is made to Annual Report of the Chief of Engineers for 1897, page 998, and for 1900, page 1490.

The winter of 1900-1901 was exceptional, in that after the closing of navigation, December 14, 1900, the ice remained firm until the final break-up about March 17, when the break-up was so gradual that it was not known just when it occurred. The examinations which have been made since the opening of navigation have developed no bad bars, though the effects of the bad ice gorges of February, 1900, are still visible.

The following table compiled from soundings taken since the resumption of navigation shows the width and depth of the deepest navigable channel through the bars and shoals as compared with those of 1900:

Locality.	1900.		1901.	
	Width.	Depth.	Width.	Depth.
	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Coxsackie shoal	300	11.0	20	12.0
Stonehouse bar	100	11.5	80	11.5
Willow Island shoal	400	12.0	270	12.0
Coeymans Cross-over	330	12.0	330	12.0
Roah Hook to North Coeymans.....	150	11.5	400	11.0
Mulls Cross-over	80	11.5	220	11.0
Nine Mile Tree Cross-over	150	11.0	200	11.5
Castleton bar	50	11.5	320	11.5
Cedar Hill bar	80	11.5	110	11.0
Winnies bar	250	11.0	450	10.5
Stone Light shoal	130	11.5	175	12.0
Beacon Island shoal	60	12.0	20	12.0
Bogart Light shoal.....	30	11.5	220	12.0
Douws Point Cross-over.....	170	12.0	220	11.5
Cuyler bar	70	12.0	20	12.0
Through draws of bridges, Albany	100	12.0	110	12.0
Bath Cross-over	200	10.0	260	11.5
Bath shoal	120	12.0	180	12.0
Kellogg shoal	100	12.0	60	12.0
Fishhouse shoal	220	12.0	220	12.0
Round shoal	60	12.0	180	11.5
Covill Folly	80	12.0	110	12.0
Opposite Breaker Island.....	130	12.0	100	12.0
Van Buren bar	140	12.0	150	12.0
Washington bar	150	12.0	150	12.0
Front of Watervliet Arsenal	50	12.0	70	12.0
Arsenal to Congress street	100	12.0	210	12.0
Through draw Congress Street Bridge.....	50	12.0	80	12.0
Congress street to Broadway, Troy	70	12.0	150	12.0
Broadway to Delaware and Hudson Company's bridge.....	60	6.0	100	12.0
Delaware and Hudson Company's bridge to State dam	50	5.5	50	5.5

The above depths refer to the plane of mean low water established in 1876.

Owing to the fact that, with the exception of the dredging at Troy, N. Y., all the dredging done during the fiscal year was for the restoration of the channel to a condition approximating that which had been obtained by previous work under the project, the above table shows apparently little improvement, whereas if no dredging had been done navigation would have been badly obstructed, if not rendered impossible, as soon as the freshet subsided by the shoals which had formed.

The removal of rock from the channel in front of Troy, N. Y., has resulted in an increased depth, but, as this work is still in an unfinished condition and requires the removal of many high points, the results can not be reported in detail yet.

The dikes did not suffer much deterioration during the year, owing to the ice being very weak when the break-up occurred, and it is expected the weakest dikes will be repaired before another winter, but very little work has so far been done under the contract now in force.

The removal of the material between the Delaware and Hudson Company's bridge and the State dam at Troy, to form a channel 150 feet wide and at least 9 feet deep, has been started and has made fair progress, considering the difficulty in disposing of the spoil, there being no depth of water yet under the fixed span and neither depth of water nor width of channel through the draw span. A portion of the spoil is being utilized to fill the space between the old bulkhead and a new one being constructed on the line recently established.

This improvement has been under the local charge of Mr. R. H. Talcott, assistant engineer, stationed at Albany.

The available balance and the appropriations recommended for fiscal year ending June 30, 1903, will be applied to continuing the excavation of the proposed channel, by means of dredging and rock removal, and for maintaining the channel already secured, by the removal of any shoals that may be formed by ice gorges or other causes.

Money statement.

July 1, 1900, balance unexpended	\$465, 119. 91
Amount appropriated by sundry civil act approved March 3, 1901.....	100, 000. 00
	565, 119. 91
June 30, 1901, amount expended during fiscal year	159, 550. 01
	405, 569. 90
July 1, 1901, balance unexpended	405, 569. 90
July 1, 1901, outstanding liabilities	43, 911. 77
	361, 658. 13
July 1, 1901, balance available.....	361, 658. 13
July 1, 1901, amount covered by uncompleted contracts.....	340, 240. 58
	1, 265, 356. 44
Amount (estimated) required for completion of existing project.....	1, 265, 356. 44
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$400, 000. 00
For maintenance of improvement.....	25, 000. 00
	425, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—

June 30, 1834	\$70, 000. 00
July 2, 1836	100, 000. 00
March 3, 1837	100, 000. 00
July 7, 1838	100, 000. 00
August 30, 1852	50, 000. 00
June 26, 1864, allotment.....	33, 000. 00
June 23, 1866	50, 000. 00
March 3, 1867	305, 188. 00
July 25, 1868, allotment	85, 000. 00
April 10, 1869, allotment.....	89, 100. 00

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By act of—

July 11, 1870	\$40,000.00	
March 3, 1871	40,000.00	
June 10, 1872	40,000.00	
March 3, 1873	40,000.00	
June 23, 1874	40,000.00	
March 3, 1875	40,000.00	
August 14, 1876	50,000.00	
June 18, 1878	70,000.00	
March 3, 1879	30,000.00	
June 14, 1880	20,000.00	
March 3, 1881	15,000.00	
August 2, 1882	10,000.00	
July 5, 1884	30,000.00	
August 5, 1886	26,250.00	
August 11, 1888	75,000.00	
September 19, 1890	119,400.00	
		\$1,667,938.00
September 19, 1890 (balance)	30,600.00	
July 13, 1892	187,500.00	
March 3, 1893	500,000.00	
August 18, 1894	145,000.00	
March 3, 1895	500,000.00	
June 11, 1896	480,000.00	
June 4, 1897	475,000.00	
July 1, 1898	160,406.56	
March 3, 1899	100,000.00	
June 6, 1900	400,000.00	
March 3, 1901	100,000.00	
		3,078,506.56
Total		4,746,444.56

CONTRACTS IN FORCE.

Name of contractor: Kirk, Driscoll & Co.

Date of contract: June 28, 1899.

Date of approval: July 12, 1899.

Date of commencement: On or before July 27, 1899.

Date of completion: June 30, 1902.

For dredging at rates of 19 cents and 24½ cents per cubic yards, and for rock removal at \$4.75 per cubic yard.

Name of contractor: James Du Bois.

Date of contract: April 10, 1900.

Date of approval: April 24, 1900.

Date of commencement: On or before May 12, 1900.

Date of completion: No date set; amount allotted, \$133,000, to be earned by June 30, 1902.

For construction and repair of dikes, material to be paid for at following rates: Piles, 9½ per linear feet; sheet piling and square timber, \$32 per 1,000 feet B. M.; round timber, 8½ cents per linear foot; iron, 3¼ cents per pound; rubblestone and spalls, 80 cents per cubic yard; paving stone, \$1.30 per cubic yard, and hire of dredging plant, \$9 per hour.

COMMERCIAL STATISTICS.

The importance of the Hudson as a great waterway of commerce is apparent from the fact that, aside from its own local traffic, which in itself is very large, it absorbs all the traffic of the Erie, Champlain, and Delaware and Hudson canals, besides the great coal trade of the Pennsylvania Coal Company at Newburg, and the Erie coal trade at Piermont.

The two principal industries on the river are ice and brick. There are said to be 87 ice houses between Albany and Hudson.

Amount of local commerce within limits of improvement.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
General merchandise	697, 554	730, 809	1, 037, 389
Grain, flour, feed, etc	737, 978	482, 510	39, 400
Lumber and timber	565, 538	995, 840	458, 224
Fuel	418, 741	857, 159	1, 364, 173
Building material	428, 245	814, 958	691, 175
Ice	1, 197, 839	1, 189, 524	1, 220, 566
Total	4, 045, 895	5, 070, 800	4, 810, 927

Number of passengers carried in 1900, 1,567,600.

In addition to this local commerce, through commerce amounting to more than 10,000,000 tons annually is carried down the river.

The boats in service in the Hudson River commerce only consist of 24 steamers, 27 sailing vessels, 90 barges, and 2,404 canal boats.

F 19.**IMPROVEMENT OF HARBOR AT SAUGERTIES, NEW YORK.**

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to May 3, 1901.]

The project at this locality provides for a permanent channel 300 feet wide and 8 feet deep. Such a channel was completed in 1892. Work since then has been applied to maintenance.

During the year no maintenance work was required. An examination of the harbor will be made at an early date with a view to determining whether any will be necessary during the coming year.

A project, with estimate of cost, for a 12-foot channel from the Hudson River to the steamboat landing, prepared in compliance with river and harbor act of March 3, 1899, was published in House Doc. 107, Fifty-sixth Congress, first session, and is printed in the report of the Chief of Engineers for 1900, pages 1518 to 1520. A supplemental estimate for continuing the improvement from the steamboat dock to the head of the harbor was also submitted on page 1495 of the same report.

The consolidated estimate appearing there was as follows:

Estimated cost of a 12-foot channel, 300 feet wide, from the Hudson River to steamboat landing	\$44, 685
Estimated cost of an 8-foot channel, 100 feet wide, from steamboat dock to within 350 feet of Porter's dock, and thence 60 feet wide to rapids below dam	76, 200
Estimated cost of a 12-foot channel, 50 feet wide, along the wharf front on the west side of the creek above steamboat landing	2, 570
Total	125, 455
Estimated annual cost of maintenance	3, 000

It is understood that a number of manufacturing interests have decided to locate along the banks of Esopus Creek, which comprises Saugerties Harbor. This will add materially to the commerce of the harbor, and it would therefore seem only just that the channel be extended so that they will have ample shipping facilities by water.

The unexpended balance will be applied in dredging or dike repairs, as may be deemed most expedient, and the appropriation for maintenance recommended for fiscal year ending June 30, 1903, will be applied

in the same manner. Should the project for the 12-foot channel be adopted, it is recommended that an appropriation of \$30,000 be made for fiscal year ending June 30, 1903.

Money statement.

July 1, 1900, balance unexpended	\$2, 150
July 1, 1901, balance unexpended	2, 150

{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	2, 500
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
July 5, 1884	\$5, 000	August 18, 1894	\$5, 000
August 5, 1886	15, 000	June 3, 1896	2, 500
August 11, 1888	12, 000	March 3, 1899	2, 500
September 19, 1890	10, 000		
July 13, 1892	5, 000	Total	57, 000

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Number.	Tonnage.	Draft.
Steam	5	2, 000	<i>Fect.</i> 7
Canal	10	1, 800	7 to 11

Passengers carried, 15,000.

Freight handled.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Bluestone	40, 000	40, 000	55, 000
Coal	11, 000	7, 000	10, 000
Building material	1, 650	1, 300	6, 873
General merchandise	5, 718	2, 500	4, 800
Total	58, 368	50, 800	76, 673

F 20.

IMPROVEMENT OF HARBOR AT RONDOUT, NEW YORK.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to May 3, 1901.]

The improvement of this harbor consists in securing a permanent 14-foot channel. This was accomplished in 1880. Since then expenditures have been applied to maintenance.

Work during the year consisted in continuing the repairs to dikes, under contract entered into October 10, 1899, with William Parrott, of Newburg, N. Y.

The available funds having all been expended by July 14, 1900, work was suspended.

The following quantities of materials were used during the year in making the repairs:

South dike:			
Square timber.....	feet B. M..	1,420	
Tie-rods, etc.....	pounds..	396	
Driftbolts, etc.....	do.....	238	
Wire rope.....	linear feet..	86	
Rubblestone.....	cubic yards..	97	
North dike:			
Rubblestone.....	cubic yards..	35	
North Branch dike:			
Square timber.....	feet B. M..	174	
Tie-rods, etc.....	pounds..	26	
Driftbolts, etc.....	do.....	20	
Rubblestone.....	cubic yards..	42	

The prices paid for the different materials in place were as follows:

White oak piling, 19 cents per linear foot; pine piling, 11 cents per linear foot; square timber, \$37 per 1,000 feet B. M.; iron, 4 cents per pound; wire rope, 5 cents per linear foot; and rubblestone, 85 cents per cubic yard.

The appropriation recommended for fiscal year ending June 30, 1903, is for maintenance, and will be applied to dredging or dike repairs, as may be most necessary.

Money statement.

July 1, 1900, balance unexpended	\$2,058.64
June 30, 1901, amount expended during fiscal year	2,058.64
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to balance available July 1, 1901	2,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
June 12, 1872	\$10,000	August 11, 1888.....	\$5,000
March 3, 1873.....	20,000	September 19, 1890	5,000
June 8, 1875, allotment	1,000	July 13, 1892.....	5,000
August 14, 1876.....	30,000	August 18, 1894.....	5,000
June 15, 1878	30,000	June 3, 1896	2,500
August 2, 1882	2,000		
July 5, 1884.....	1,000		
August 5, 1886	2,500	Total	119,000

COMMERCIAL STATISTICS.

Freight handled.

Articles.	1897.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
General merchandise	900,000	600,000	600,000
Coal	385,000	250,000	250,000
Brick	280,000	275,000	275,000
Building stone	215,000	200,000	200,000
Cement, lime, and sand.....	510,000	500,000	500,000
Ice	40,000	60,000	60,000
Total	2,330,000	1,885,000	1,885,000

F 21.

IMPROVEMENT OF HARBOR AT PEEKSKILL, NEW YORK.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to May 3, 1901.]

The project for improvement at this locality consists in dredging a channel, 100 feet wide and 10 feet deep, from deep water in the Hudson River, on the north, along the inner side of the harbor, to deep water on the south. This project was completed in 1899.

No work was done during the year.

Since this work began the commerce in Peekskill Harbor has increased so much that a channel 100 feet wide and 10 feet deep is no longer considered adequate. Those principally interested ask that the channel along the wharf front be made 200 feet wide and the northerly and southerly connections 150 feet wide, with a depth of 15 feet at mean low water. These dimensions of channel can be obtained at no greater cost than was originally estimated for channels of less size, provided the cost of dredging is as low as that secured at the last letting.

For the reasons stated it seems advisable to continue this improvement until channels of the larger dimensions have been secured, provided the cost does not exceed the original estimate.

The available balance will be expended for maintenance whenever the necessity arises, and the appropriation recommended for fiscal year ending June 30, 1903, will be applied to increasing the dimensions of the existing channel and in maintenance of the same.

Money statement.

July 1, 1900, balance unexpended	\$600.00
July 1, 1901, balance unexpended	600.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$30,000.00
For maintenance of improvement.....	3,000.00
	33,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—	
June 3, 1896	\$10,000
March 3, 1899.....	10,000
Total	
	20,000

COMMERCIAL STATISTICS.

Freight handled.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
General merchandise.....	470,350	720,455	1,132,700
Building material.....	42,300	58,500	157,750
Coal and wood	119,300	164,000	286,000
Lumber	83,000	124,500	187,000
Molding sand.....	20,000	25,000	37,500
Total			
	734,950	1,092,455	1,800,950

These freights were carried in steam and sail vessels, barges, and canal boats drawing from 5 to 12 feet of water.

F 22.

IMPROVEMENT OF PASSAIC RIVER, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 8, 1901.]

The project for this locality proposes a channel 200 feet wide and 10 feet deep from Newark Bay to the Center Street Bridge, Newark, and thence from 50 to 200 feet wide and from 6 to 7½ feet deep to the head of navigation at Passaic.

Work during the year was carried on under the contract with Joseph Oliver Stokes, and consisted in increasing the dimensions of the channel at Belleville, Rutherford Park, and Passaic City.

At Belleville bar shoals in the channel, composed of large and small bowlders embedded in gravel and clay, were removed to a depth of 6 feet at mean low water over the full width of the channel, 100 feet, for a length of 1,000 feet above the Montclair and Greenwood Lake Railway Bridge. For the remainder of the distance across the bar, 1,400 feet, the shoals were removed to grade over a width of 50 feet. The total quantities removed from Belleville bar were 2,636 cubic yards gravel, 18.15 cubic yards bowlders, and 0.33 cubic yard of ledge rock.

At Rutherford Park bar shoals, formed partly of red sandstone uncovered by dredging in 1893 and partly of fine sand and gravel deposited since then, were removed from the channel on the easterly side. The area, cleared to a depth of 6 feet below the mean low-water plane of 1873 by the removal of 3,925 cubic yards of gravel, 25.6 cubic yards of bowlders, and 292.6 cubic yards of ledge rock, was 1,150 feet long by 45 feet wide.

Small areas near the Erie Railroad and Union Avenue county bridges were dredged to a depth of 6 feet, which necessitated the removal of 706 cubic yards of gravel and 1.85 cubic yards of bowlders.

The total quantities of materials removed under the contract, also prices paid for the work, were as follows:

7,267 cubic yards of gravel at a cost of 36 cents per cubic yard.
45.60 cubic yards of bowlders at a cost of \$16.20 per cubic yard.
292.93 cubic yards of ledge rock at a cost of \$17.33 per cubic yard.

The following statement shows what work has been done under the project:

In Newark Bay a channel of the proposed dimensions has been completed and 6,205 linear feet of dikes have been built. At some localities additional dredging for maintenance has been necessary.

A channel of the proposed dimensions has been completed in Passaic River up to the Center Street Bridge at Newark. Additional dredging for maintenance has been necessary at some places.

Between Center Street Bridge and Passaic City channels have been completed at Middle, Lime Kiln, Third River, and Holzman bars. Additional dredging for maintenance has not been necessary at all, excepting Third River bar.

The required depth has been attained at Belleville bar for widths of

50 to 100 feet, at Rutherford Park bar for widths of 85 to 100 feet, and above Rutherford Park bar to Passaic City, for narrow widths.

The amount required for completion of existing project has been increased by \$78,740, which amount has been expended, from time to time, in maintaining work already accomplished.

To maintain the dikes and channels already made, an annual appropriation of \$15,000 is considered necessary.

The appropriations recommended for the fiscal year ending June 30, 1903, are to be applied to continuing work between Center Street Bridge, Newark, and Passaic City, by means of dredging and rock removal, and maintaining the present channels below the Center Street Bridge.

The river and harbor act of March 3, 1899, provided for an examination and survey of this river, with a view to obtaining a channel 10 feet deep from the Montclair Railway Bridge to the Center Street Bridge, Newark, and thence 12 feet deep to Staten Island Sound; also for an examination from the Montclair Railway Bridge to the city of Paterson.

Reports on these examinations and surveys, with estimates of cost of proposed improvements, were published in House Doc. No. 401, Fifty-sixth Congress, first session, and are printed in the Report of the Chief of Engineers for 1900, pages 1530 to 1552.

Money statement.

July 1, 1900, balance unexpended	\$8,970.47
June 30, 1901, amount expended during fiscal year	8,930.47
July 1, 1901, balance unexpended	40.00
July 1, 1901, outstanding liabilities	40.00
{ Amount (estimated) required for completion of existing project	158,087.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$30,000.00
For maintenance of improvement	15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	45,000.00

APPROPRIATIONS.

By act of—		By act of—	
June 10, 1872	\$25,000	July 5, 1884	\$28,000
March 3, 1873	25,000	August 5, 1886	26,250
June 23, 1874	20,000	August 11, 1888	35,000
March 3, 1875	20,000	September 19, 1890	45,100
August 10, 1876	10,000	July 13, 1892	45,000
June 18, 1878	10,000	August 18, 1894	15,000
March 3, 1879	2,000	June 3, 1896	15,000
June 14, 1880	32,000	March 3, 1899	15,000
March 3, 1881	50,000		
August 2, 1882	50,000	Total	468,350

COMMERCIAL STATISTICS.

Freight handled and shipped by water.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Building materials	470,368	561,517	589,593
Ores and metals	120,908	173,500	182,175
Fertilizers	72,093	60,100	63,105
Coal	124,746	109,755	115,242
Miscellaneous merchandise	349,967	593,167	622,825
To and from Hackensack River	371,690	464,423	464,423
Total	1,509,772	1,962,462	2,037,363

The commerce is largely coastwise and carried in sail and steam vessels, canal boats, and barges drawing from 5 to 14 feet of water.

The number of vessels entered and cleared at the United States custom-house, Newark, N. J., on the Passaic River, during the year 1900 was 150; the tonnage, 36,810 tons.

F 23.

IMPROVEMENT OF CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project for this locality consists in dredging a channel 400 feet wide and 14 feet deep, through the lower end of Newark Bay, so as to connect the Arthur Kill and the Kill van Kull.

Work during the year was carried on under a contract with Kirk, Driscoll & Co., of Syracuse, N. Y., and consisted in redredging the channel where the contraction was the greatest, and in removing small shoals from around the sharp bend at the Corner Stake Light. The total amount of material removed under the contract was 97,193 cubic yards, at a cost of 18 cents per cubic yard.

At the close of the work the channel connecting Arthur Kill with the Kill van Kull was 350 feet wide and 14 feet deep.

The amount required for completion of existing project has been increased by \$93,383, which amount has been expended, from time to time, in maintaining work already accomplished.

To maintain the channel already dredged an annual appropriation of \$10,000 is considered necessary.

The appropriations recommended for the fiscal year ending June 30, 1903, are to be applied to increasing the width of the channel to the full dimensions proposed by the project and in maintaining the work already done.

The river and harbor act of March 3, 1899, provided for an examination and survey of Arthur Kill, or Staten Island Sound, from Kill van Kull to Raritan Bay, with a view to obtaining a 21-foot channel from New York Bay to Raritan Bay.

The reports on this examination and survey, giving estimates of cost of proposed improvement, were published in House Doc. 393, Fifty-sixth Congress, first session, and are printed in the Report of Chief of Engineers for 1900, pages 1525 to 1530.

Money statement.

July 1, 1900, balance unexpended	\$20,543.35
June 30, 1901, amount expended during fiscal year	18,524.85
July 1, 1901, balance unexpended	2,018.50
{ Amount (estimated) required for completion of existing project	93,383.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$20,000.00
For maintenance of improvement	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	30,000.00

APPROPRIATIONS.

By act of—		By act of—	
June 23, 1874.....	\$50,000	September 19, 1890	¹ \$22,000
August 14, 1876.....	10,000	July 13, 1892	² 20,000
June 18, 1878.....	15,000	August 18, 1894.....	² 10,500
June 14, 1880.....	29,000	June 3, 1896.....	³ 13,000
August 2, 1882.....	40,000	March 3, 1899	32,000
July 5, 1884.....	10,000		
August 5, 1886.....	15,000	Total	291,500
August 11, 1888.....	25,000		

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal and ores.....	7,404,164	8,349,095	9,148,111
Clay products	914,553	1,121,333	803,286
Chemicals and fertilizers.....	244,135	237,666	259,942
Oils.....	63,043	60,048	64,129
Grain.....	877,659	751,124	129,474
Machinery and manufactures.....	258,296	263,229	109,023
General merchandise	422,411	529,496	533,668
Total	10,184,261	11,311,991	11,047,633

The above statement is based on individual reports representing a large per cent of the total tonnage reported.

The commerce for the year 1900 was valued at \$156,601,921.

The valuation of ores only was \$63,875,000.

The freights are carried in barges, canal boats, and steam and sailing vessels, drawing from 5 to 23 feet of water.

¹ Includes appropriations made for improving Arthur Kill, New York and New Jersey.

² Unexpended balance from appropriation for improving Arthur Kill, New York and New Jersey.

³ Includes \$5,000 for Lemon Creek.

F 24.

IMPROVEMENT OF ELIZABETH RIVER, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900, of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 30, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project for improving this stream consists in dredging a channel, 60 feet wide and 7 feet deep at mean high water, from the mouth to the head of navigation at Elizabeth.

No work was done during the year; no funds being available for that purpose.

The existing project has never been completed. When work was last suspended, a channel, 7 feet deep at mean high water, and from 30 to 60 feet wide, had been dredged from the mouth to Bridge street, Elizabeth.

The amount required for completion of existing project has been increased by \$16,160, which amount has been expended, from time to time, in maintaining work already accomplished.

To maintain the channel already dredged an annual appropriation of \$5,000 is considered necessary.

The appropriations recommended for fiscal year 1903 are to be applied to increasing the dimensions of the channel and maintaining that already secured, by dredging.

Money statement.

{ Amount (estimated) required for completion of existing project.....	\$16,160.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903:	
For works of improvement.....	\$8,000.00
For maintenance of improvement	5,000.00
	13,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1879.....	\$7,500	July 13, 1892.....	\$5,000
June 14, 1880	7,500	August 18, 1894	3,000
March 3, 1881	4,000	June 3, 1896	3,160
August 2, 1882	8,000		
September 19, 1890	5,000	Total	43,160

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1895.	1896	1897.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	13,300	18,000	14,270
Lumber		6,700	3,000
Building material	8,000	8,650	8,750
Miscellaneous	350	2,716	2,845
Total	21,650	36,066	28,865

A statement of the number, character, tonnage, etc., of the vessels employed in this trade could not be procured.

F 25.

IMPROVEMENT OF RARITAN RIVER, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project for this improvement contemplates making a permanent channel 200 feet wide and 10 feet deep from the mouth of the Delaware and Raritan Canal terminus at New Brunswick.

No work was done during the fiscal year.

The following has been accomplished under the project:

A channel 10 feet deep has been made from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, the section through and below the reef at Whitehead's dock having a width of 200 feet and the section above the reef a width of 100 feet.

To maintain the work already done an annual appropriation of \$10,000 is considered necessary.

The appropriations recommended for fiscal year ending June 30, 1903, are to be expended in widening the channel between Whitehead's dock and New Brunswick, and in maintaining the work already accomplished.

To complete this project it will require 182,000 cubic yards of dredging, at 27½ cents; 222,000 cubic yards, at 44 cents; 35,000 cubic yards of rock removal, at \$3.30; 7,500 linear feet of dike construction, at \$6.60; 17,300 linear feet of dike repairs, at \$2.20, and 1,000 feet of shore protection, at \$4.40. If project is amended by reducing width of channel above Rocky reach from 200 to 100 feet, which will be ample for the needs of commerce for many years to come, the item of rock removal can be omitted from the project for completion.

Money statement.

July 1, 1900, balance unexpended	\$3, 557. 68
June 30, 1901, amount expended during fiscal year	7. 68
July 1, 1901, balance unexpended	3, 550. 00
{ Amount (estimated) required for completion of existing project	363, 750. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$30,000. 00
For maintenance of improvement	10, 000. 00
	40, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
June 18, 1878	\$200, 000	September 19, 1890	\$50, 000
March 3, 1879	60, 000	July 13, 1892	40, 000
June 14, 1880	100, 000	August 18, 1894	20, 000
March 3, 1881	25, 000	June 3, 1896	20, 000
August 2, 1882	25, 000	March 3, 1899	20, 000
July 5, 1884	35, 000		
August 5, 1886	26, 250	Total	671, 250
August 11, 1888	50, 000		

In addition to the above \$13,963 was appropriated for improving New Brunswick Harbor, New Jersey, in 1836-37.

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal, clay, ores, etc.....	311,046	350,790	613,464	484,350
Manufactures, mainly brick.....	652,922	658,986	698,998	755,846
Lumber.....	40,428	33,279	49,218	74,791
Miscellaneous.....	214,356	212,917	161,711	161,658
Total.....	1,218,752	1,255,972	1,523,391	1,476,645

The commerce of 1900 was valued at \$33,446,582, and was carried in barges, canal boats, steam and sail vessels drawing from 5 to 17 feet of water. The total of all trips reported was 14,902, exclusive of trips by tugs and excursion steamers.

F 26.

IMPROVEMENT OF SOUTH RIVER, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project for improving this stream consists in making a channel 100 feet wide and 8 feet deep to Washington, thence 6 feet deep to Bissetts, and thence 4 feet deep to Old Bridge, also in correcting the outlet of the canal connecting South and Raritan rivers.

No work was done during the fiscal year.

In carrying out the project the following work has been accomplished:

Below Washington a channel from 50 to 75 feet wide and from $7\frac{1}{2}$ to 8 feet deep has been dredged, and the projected dikes have been built. Above Washington a channel from 50 to 75 feet wide and 6 feet deep has been dredged as far as the Raritan Railroad bridge.

To complete this project about 10,400 linear feet of dikes remain to be built, and at least 100,000 cubic yards of material must be dredged.

To maintain the work already done an annual appropriation of \$5,000 is considered necessary.

The appropriations recommended for fiscal year ending June 30, 1903, are to be applied to dredging and dike construction.

Money statement.

Amount (estimated) required for completion of existing project.....	\$101,695.00
Amount that can be profitably expended in fiscal year ending June 30, 1903:	
For works of improvement.....	\$20,000.00
For maintenance of improvement.....	5,000.00
	25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—

March 3, 1871.....	\$15, 000	
March 3, 1873.....	5, 000	
		\$20, 000
June 14, 1880.....	40, 000	
March 3, 1881.....	6, 000	
August 2, 1882.....	10, 000	
August 5, 1886.....	5, 000	
August 11, 1888.....	5, 000	
September 19, 1890.....	5, 000	
July 13, 1892.....	7, 000	
August 18, 1894.....	5, 000	
June 3, 1896.....	5, 000	
March 3, 1899.....	5, 000	
		93, 000
Total		113, 000

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1897.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal, clay, ore, etc.....	64, 916	60, 035	87, 400	101, 900
Manufactures, brick, etc.....	243, 185	209, 684	248, 212	311, 078
Miscellaneous.....	462	4, 662	7, 590	1, 310
Total.....	308, 563	274, 381	343, 202	414, 288

The commerce of 1900 was carried in barges, canal boats, steam and sail vessels drawing from 5 to 12 feet of water and estimated to have made 4,192 single trips. The value of the commerce of 1900 was estimated at \$1,355,470.

F 27.

IMPROVEMENT OF RARITAN BAY, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project for this improvement contemplates dredging 21-foot channels, 300 feet wide from Seguine Point to deep water in the bay, through two shoals opposite Wards Point, and from South Amboy to deep water near Great Beds light.

No work was done during the year, the funds on hand being insufficient in amount to effect any material improvement in the dredged channels.

In carrying out the project the following work has been accomplished: The channel off Seguine Point has been dredged to a depth of 21 feet for a width of 250 feet throughout the entire length.

The channel off Wards Point has been dredged to a depth of 21 feet for a width of 300 feet from the wharves at Perth Amboy to the bend at Great Beds light, and thence across the crest of the shoal between the bend and Seguine Point.

The channel from Great Beds light to South Amboy has been dredged to a depth of 21 feet for a width of 300 feet, without allowance in width to provide for stable side slopes.

The amount required for completion of existing project has been increased by \$144,000, which amount has been expended from time to time in maintaining work already accomplished.

To maintain the channels already dredged an annual appropriation of \$20,000 is considered necessary.

The appropriations recommended for fiscal year ending June 30, 1903, are to be applied to dredging the channels to their full dimensions and in maintaining the portions already completed.

Money statement.

July 1, 1900, balance unexpended	\$1, 185. 55
June 30, 1901, amount expended during fiscal year	255. 55
July 1, 1901, balance unexpended	930. 00
(Amount (estimated) required for completion of existing project	209, 375. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$60, 000. 00
For maintenance of improvement	20, 000. 00
	80, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1881	\$50, 000	July 13, 1892	\$40, 000
August 2, 1882	50, 000	August 18, 1894	40, 000
July 5, 1884	20, 000	June 3, 1896	75, 000
August 5, 1886	37, 500	March 3, 1899	65, 000
August 11, 1888	25, 000		
September 19, 1890	40, 000	Total	442, 500

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal, ores, etc	4, 293, 827	4, 682, 184	5, 412, 640
Lumber	33, 279	51, 883	78, 707
Building material		1, 150, 245	718, 346
Fertilizers	131, 162	162, 545	172, 772
Manufactures	900, 363	65, 702	
Merchandise	193, 843	394, 843	155, 512
Total	5, 552, 474	6, 507, 402	6, 537, 977

About 5,295,558 tons of the commerce of 1900 passed through the South Amboy channel, about 2,301,530 tons through the Seguin Point channel, and about 5,478,866 tons through the Wards Point channel.

The commerce of 1900 was valued at \$53,200,720, and was carried in barges, canal boats, steam and sail vessels drawing from 5 to 23 feet of water. The total number of trips of vessels passing through the South Amboy channel was 68,393, including 9,940 trips of tugs.

The total number of vessels entered or cleared at the custom-house at Perth Amboy, N. J., during the year 1900 was 288; total tonnage, 156,917 tons.

F 28.

IMPROVEMENT OF MATAWAN CREEK, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project consists in dredging a 4-foot channel, 100 feet wide from the mouth to Winkson Creek, and thence 75 feet wide to railroad bridge at Matawan.

No work was done during the year owing to the fact that there were no funds available for expenditure.

The existing project has never been completed. When work was last suspended the channel had a least width of 80 feet at the outlet into Keyport Harbor and least width of 40 feet in the creek as far up as the steamboat dock at Matawan, the depth being 4 feet, except for a short distance below the Matawan steamboat dock, where it was 3½ feet on the south side of the channel.

The amount required for completion of existing project has been increased by \$21,120, which amount has been expended from time to time in maintaining work already accomplished.

To maintain the channel already dredged an annual appropriation of \$3,000 is considered necessary.

The appropriations recommended for fiscal year ending June 30, 1903, are to be expended in extending the channel and maintaining the improvements already made.

Money statement.

Amount (estimated) required for completion of existing project.....	\$12, 120. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903:	
For works of improvement.....	\$6, 000. 00
For maintenance of improvement.....	3, 000. 00
	9, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1881.....	\$15, 000	June 3, 1896.....	\$3, 000
August 2, 1882.....	6, 000	March 3, 1899.....	3, 000
September 19, 1890.....	2, 500		
July 13, 1892.....	9, 620	Total.....	42, 120
August 18, 1894.....	3, 000		

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1899.
	<i>Tons.</i>
Farm produce and general merchandise.....	35, 000
Brick.....	12, 000
Fertilizers.....	4, 000
Total.....	51, 000

The commerce of 1899 was carried in barges, canal boats, steam and sail vessels, drawing from 5 to 8 feet of water and carrying from 50 to 200 tons.

The statement of commerce is approximate only, based on the incomplete returns furnished.

No commercial statistics were furnished for the year 1900, although efforts were made to procure them.

F 29.

IMPROVEMENT OF HARBOR AT KEYPORT, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project for improvement consists in dredging an 8-foot channel 200 feet wide from Raritan Bay to the steamboat dock at Keyport.

No work was done during the year, owing to lack of funds.

The existing project has never been completed. When operations were last suspended the channel from Raritan Bay to the steamboat dock had a depth of from 5 to 8 feet and width of from 70 to 100 feet.

The amount required for completion of existing project has been increased by \$9,975, which amount has been expended from time to time in maintaining work already accomplished.

It is estimated that an annual appropriation of \$5,000 will be necessary to maintain the channel already made.

The appropriations recommended for the fiscal year ending June 30, 1903, are to be expended in extending the channel and maintaining the improvements made.

Money statement.

Amount (estimated) required for completion of existing project	\$9,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1903:	
For works of improvement	\$9,975.00
For maintenance of improvement	5,000.00
	14,975.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—

August 2, 1882.....	\$30,475
July 13, 1892.....	5,000
August 18, 1894.....	5,000
June 3, 1896.....	2,500
March 3, 1899.....	2,500
Total.....	45,475

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1896.	1897.	1899.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Farm produce.....	60,700	63,700	40,000
Fertilizers.....	8,000	8,000	5,000
Coal and lumber.....	8,500	8,500	5,800
Fish and shellfish.....	10,000	10,000	9,600
Miscellaneous.....	18,000	18,900	7,100
Total.....	105,200	109,100	67,500

The commerce of 1899 did not differ materially from that of preceding years. The apparent decrease is due to the different sources from which information was obtained.

To the above the commerce of Matawan Creek should be added, as it passes in and out through Keyport Harbor. During 1899 this commerce amounted to 51,000 tons.

During 1899 the number of passengers carried was 29,825. No new lines of transportation were established.

No commercial statistics were furnished for the year 1900, although efforts were made to procure them.

F 30.

IMPROVEMENT OF SHOAL HARBOR AND COMPTON CREEK, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The present project proposes dredging a 4-foot channel 150 feet wide through Shoal Harbor and 75 feet wide in Compton Creek up to the railroad bridge, the channel in Shoal Harbor to be protected by a dike if found necessary.

No work was done during the year, owing to lack of funds.

The existing project has never been completed. When operations were last suspended there was a 4-foot channel 75 feet wide through Shoal Harbor, connecting Raritan Bay with Compton Creek.

The amount required for completion of existing project has been increased by \$7,000, which amount has been expended from time to time in maintaining work already accomplished.

To maintain the channel already dredged an annual appropriation of \$5,000 is considered necessary.

The appropriations recommended for fiscal year ending June 30, 1903, are to be applied to extending and maintaining the channel already made, by means of dredging.

Money statement.

Amount (estimated) required for completion of existing project	\$47, 130. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903:	
For works of improvement.....	\$15, 000. 00
For maintenance of improvement.....	5, 000. 00
	20, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—	
September 19, 1890	\$5, 000
July 13, 1892	3, 000
August 18, 1894	3, 000
June 3, 1896	5, 000
March 3, 1899	8, 000
Total	24, 000

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1897.	1898.	1899	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Farm produce	70,000	75,000	100,000	90,000
Fish and shellfish	75,000	75,000	80,000	75,000
Coal	4,000	4,500	4,000	5,000
Fertilizers	25,000	30,000	30,000	8,500
Miscellaneous	10,000	10,000	12,000	1,000
Total	184,000	194,500	226,000	179,500

The above freight was carried by one steamer and 250 sailboats, drawing from 2 to 5 feet of water, and whose tonnage varied from 5 to 420 tons.

F 31.

IMPROVEMENT OF SHREWSBURY RIVER, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The project for the improvement of this stream proposes the making of channels 6 feet deep and from 150 to 300 feet wide from the outer bar at the mouth of the river to Red Bank on the North Branch and Branchport on the South Branch.

Work during the year was carried on under a contract with the Shrewsbury Dredging Company, of Long Branch, N. J., and consisted in redredging the channel in the main stem east of Island Beach. This was made 6 feet deep and 40 feet wide for a distance of 1,025 feet.

The total quantity of sand removed from the channel was 19,250 cubic yards, at a cost of 24.6 cents per cubic yard; 13.7 cubic yards of stone was also removed, at a cost of \$8 per cubic yard; and 85 piles, forming an old dock, were drawn, at a cost of \$2 each.

In carrying out the project the following work has been accomplished:

In the main stem channels of the required dimensions had been dredged across the shoals and maintained at the outer bar by a training dike. The improved channel inside the bar opposite Island Beach was completely filled in 1897 by a breach in the Sandy Hook peninsula through which an immense quantity of ocean sand was brought into the river. The breach has been closed and the channel is now being redredged.

In the North Branch channels 6 feet deep and from 100 to 200 feet wide have been secured by dredging and training dikes.

In the South Branch training dikes have been built and channels dredged to the required depth.

To maintain work already accomplished an annual appropriation of \$10,000 is considered necessary.

The appropriations recommended for fiscal year ending June 30, 1903, are to be expended in increasing the dimensions of the channel and in

maintaining those now existing by dredging and by the construction of dikes.

The channel in the main stem of this river was completely closed during the winter of 1896-97, when the sea broke through the Sandy Hook peninsula, opposite Island Beach, carrying with it sufficient sand to fill the improved channel to above the ordinary high-water mark. The breach has been closed by the Engineer Department by means of a stone wall, which is now being raised in height, but it has been impossible to restore the channel to its original dimensions with the small appropriations made in 1899 and 1900.

To complete the existing project the sum of \$65,562 is considered necessary, which amount was expended from time to time for maintenance. It is therefore respectfully recommended that this full amount be appropriated in the next river and harbor bill, so that the channel in the main stem may be completed, thereby allowing the two steamboat lines plying between New York City and this river to make regular trips instead of running irregularly on tides. During the past two seasons steamboats loaded with passengers and freight have frequently been aground for hours; this has caused quite a falling off in the business of both lines.

Money statement.

July 1, 1900, balance unexpended	\$10,000.00
June 30, 1901, amount expended during fiscal year	3,281.91
July 1, 1901, balance unexpended	6,718.09
July 1, 1901, outstanding liabilities	3,659.37
July 1, 1901, balance available.....	3,058.72
July 1, 1901, amount covered by uncompleted contracts.....	2,706.00
{ Amount (estimated) required for completion of existing project	65,562.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$65,562.00
For maintenance of improvement.....	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	75,562.00

APPROPRIATIONS.

By act of—		By act of—	
August 30, 1852.....	\$1,500	August 11, 1888.....	\$10,000
March 3, 1871.....	14,000	September 19, 1890.....	10,000
March 3, 1873.....	5,000	July 13, 1892.....	10,000
		August 18, 1894.....	5,000
	20,500	June 3, 1896.....	15,000
		March 3, 1899.....	10,000
June 18, 1878.....	18,000	June 6, 1900, allotment....	10,000
March 3, 1879.....	10,000		
June 14, 1880.....	30,000		254,000
March 3, 1881.....	86,000		
August 2, 1882.....	30,000	Total	274,500
August 5, 1886.....	10,000		

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: Shrewsbury Dredging Company.

Date of contract: July 20, 1900.

Date of approval: September 14, 1900.

Date of commencement: September 28, 1900.

Date of completion: January 25, 1901.

Removal of about 30,060 cubic yards of sand, at 24.6 cents per cubic yard; of 85 piles, at \$2 each, and of 13.7 cubic yards of stone, at \$8 per cubic yard.

Work has been continued under an implied contract with the same company and under the same terms, by authority of the Chief of Engineers, dated February 15, 1901.

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1898.	1899.	1900.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Farm produce	350,000	300,000	250,000
Fish and shellfish	13,000	12,000	10,000
Coal	30,000	32,000	32,000
Lumber	1,500	2,000	2,000
Building material	8,500	10,000	10,000
Miscellaneous	600,000	550,000	500,000
Total	1,003,000	906,000	804,000

Passengers carried, 327,316.

The commerce given for 1900 was carried in 10 steamers, 5 tugs, 18 sailing vessels, and 3 canal boats, whose draft varied from 3 to 7 feet and tonnage from 20 to 500 tons. During the year 1900 the number of vessels passing through the drawbridge at Highlands was 7,437.

F 32.

IMPROVEMENT OF MANASQUAN (SQUAN) RIVER, NEW JERSEY.

[This work was in the charge of Col. J. W. Barlow, Corps of Engineers (now brigadier-general, Chief of Engineers, United States Army, retired), to November 30, 1900; of Maj. E. H. Ruffner, Corps of Engineers, from November 30, 1900, to April 20, 1901, and of General Barlow from April 20 to May 3, 1901.]

The proposed improvement at this locality consists in obtaining a permanent outlet from the river into the ocean, 6 feet deep, by means of dikes, also in dredging the channel in the lower part of the river to the same depth.

A dike 1,515 feet long had been constructed to the north of the proposed outlet, at the same time a length of 475 feet of a south dike was built. The latter dike has been undermined by the currents and the timber eaten by the teredo. Owing to changes in the river bed the ruins of this dike lie directly across the present channel, making passage impossible for boats drawing more than 2 feet of water. Until the dike proposed under the present project has been built, south of the outlet, no improvement may be expected.

The amount required for completion of existing project has been increased by \$1,075, which amount has been expended from time to time in maintaining work already accomplished.

No work was done during the year, as the funds on hand would not permit of the construction of a sufficient length of the proposed south dike to result in any benefit to navigation.

The balance available will be retained until another appropriation shall have been made, with the expectation that the expenditure of a larger amount of money will enable the work to be done more economically.

The appropriations recommended for the fiscal year ending June 30, 1903, will be expended in constructing as much of the south dike as possible.

Money statement.

July 1, 1900, balance unexpended	\$5, 925. 00
July 1, 1901, balance unexpended	5, 925. 00
{ Amount (estimated) required for completion of existing project	14, 375. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	14, 375. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—	
March 3, 1879	\$12, 000
June 14, 1880	20, 000
August 2, 1882	7, 000
September 19, 1890	2, 000
March 3, 1899	5, 000
Total	46, 000

COMMERCIAL STATISTICS.

The commerce of this river amounts practically to nothing, owing to obstructions at the inlet. The river is largely used by pleasure craft during the summer season.

F 33.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. *Wreck of schooner Richard Hall in Long Island Sound off Port Chester Harbor, N. Y.*—This vessel, a two-masted schooner, sank October 1, 1898, in Long Island Sound off Port Chester Harbor, N. Y., in 40 feet of water, both masts being visible.

The wreck was reported October 15, 1898, and the removal of the parts dangerous to navigation was authorized October 18, 1898.

An examination made May 28, 1901, showed that the wreck has been removed to the contemplated depth of 25 feet below mean low water, partly under an agreement with the Merritt & Chapman Derrick and Wrecking Company, and partly by natural causes.

The cost to the United States for the removal of the wreck has been \$32.25.

Nothing of value was recovered from it.

2. *Wreck of steamship Macedonia in Atlantic Ocean off Seabright, N. J.*—The steamer *Macedonia* sank in the Atlantic Ocean on June 13, 1899, about two miles off shore from Seabright, N. J.

The wreck was reported on June 26, and its removal was authorized July 15, 1899.

Private enterprise has been engaged in removing this wreck, but failed to do so, and proposals for its removal by the United States were invited, and opened October 31, 1900. The two bids received in response were rejected as excessive, and an open market offer to remove the dangerous parts of the wreck to a depth of 30 feet below mean low water, for the sum of \$2,800, was accepted. Under this agreement the work was to be completed February 18, 1901; but as at that time no appreciable progress had been made, the work was again advertised. Proposals were opened April 10, 1901, and a contract was entered into with the lowest bidder to do the required work for the sum of \$3,800.

The removal of the wreck was completed June 10, 1901, at a cost to the United States of \$4,800.

Under the terms of the contract all the materials recovered belonged to the contractor.

3. *Wreck of coal barge Satanella in Raritan Bay, N. J.*—The *Satanella* was an iron-hulled steamboat which had been changed into a coal barge. The obstruction was reported February 9, and its removal authorized February 23, 1900.

At the close of the last fiscal year this wreck was being removed by Booye & Townsend, of Atlantic City, N. J., under contract dated April 14, 1900.

The removal of the wreck was completed September 25, 1900, at a cost to the United States of \$2,300.

Under the terms of the contract all the materials recovered belonged to the contractors.

4. *Wreck of barge Jenima Leonard, in Communipaw Channel, N. J.*—This wreck was a lumber barge, which was badly burnt in the Hoboken fire June 30, 1900, and drifted downstream and finally lodged on the Jersey Flats, from whence it was drawn into the Communipaw Channel during an unusually high tide. The wreck was reported August 31, and its removal was authorized September 6, 1900.

The wreck was removed at a cost to the United States of \$350.

Nothing of value was recovered from it.

5. *Wreck of sloop Success in Shrewsbury River, N. J.*—This wreck was the hull of an abandoned sloop which had lodged in the bed of the Shrewsbury River opposite Island Beach, alongside of the proposed channel, into which it would have slid as soon as channel had been dredged. The wreck was reported September 10, and its removal authorized September 13, 1900.

The wreck was removed at a cost to the United States of \$50.

Nothing of value was recovered from it.

6. *Wreck of the canal boat A. S. Hatch, in channel between Staten Island and New Jersey, N. Y. and N. J.*—Notification was received from the board of commissioners of pilotage of New Jersey that the derelict canal boat *A. S. Hatch* had lodged in the channel near the Corner Stake light. The wreck was reported September 15, and its removal authorized September 20, 1900.

The wreck was removed at a cost to the United States of \$275.

Nothing of value was recovered from it.

7. *Wreck of lighter Union in Hudson River, N. Y.*—The *Union*, originally a schooner which had been changed into a lighter, sank in the channel of the Hudson River, opposite Haverstraw, N. Y. The wreck was reported February 12, and its removal authorized February 15, 1901.

The wreck was removed at a cost to the United States of \$480.

Nothing of value was recovered from it.

8. *Unknown wreck in East River off Greenpoint, N. Y.*—This wreck (name unknown) was found lying in the East River, N. Y., in a line with Greene Street dock, Greenpoint, N. Y., distant about 500 feet. It had from 20 to 23 feet of water over it, mean low water, the surrounding depth of the river being about 40 feet.

The wreck was reported March 18, 1901, and its removal was authorized April 10, 1901.

The wreck was raised bodily and taken to the yard of John F. Baxter, at Weehawken, N. J.

The wreck was removed at a cost to the United States of \$800.

Nothing of value was recovered.

9. *Wrecks of canal boat B. P. Ransom and of unknown lighter in New York Harbor.*—Attention to these wrecks was called by the Commissioner of Immigration in New York City, on May 29, 1901.

An examination showed that one was the canal boat *B. P. Ransom*, grounded in 6 feet of water, mean low tide, about 500 feet north of Ellis Island, New York Harbor; and the other a harbor lighter, name unknown, lying in the same depth of water, about 100 feet out from the southeasterly corner of the island.

Report upon these wrecks was submitted June 10, and their removal authorized June 12, 1901.

Proposals for the removal of the wrecks were invited June 10, and opened June 20, 1901. The bid of John F. Baxter for \$389, the lowest of five received, was accepted.

The wrecks were raised bodily and taken to the yard of John F. Baxter, at Weehawken, N. J.

The wrecks were removed at a cost to the United States of \$410.

Nothing of value was recovered.

ABSTRACT OF CONTRACTS IN FORCE DURING YEAR.

Name of contractor: Charles W. Booye and Enoch Townsend.

Date of contract: April 14, 1900.

Date of approval: May 3, 1900.

Date of commencement: May 15, 1900.

Date of completion: October 14, 1900.

Removal of wreck *Satanella* for the sum of \$1,765.

Name of contractor: Charles W. Johnston.

Date of contract: April 22, 1901.

Date of approval: May 10, 1901.

Date of commencement: May 1, 1901.

Date of completion: June 30, 1901.

Removal of wreck *Macedonia* for the sum of \$3,800.

F 34.

EXAMINATION AND SURVEY OF GREAT SOUTH BAY AND PATCHOGUE RIVER, NEW YORK.

[Printed in House Doc. No. 103, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 30, 1900.

SIR: I have the honor to submit herewith copies of reports dated August 20 and November 14, 1900, by Maj. E. H. Ruffner, Corps of Engineers, upon preliminary examination and survey, respectively, of Fire Island Inlet, in Great South Bay, to Patchogue River, New York, with a view to obtaining a channel not less than 10 feet in depth and 200 feet in width at mean low water, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

Major Ruffner presents a plan for improvement by dredging, with a view to obtaining a channel 10 feet deep and 200 feet wide from Fire Island Inlet to the central basin in Great South Bay, at mouth of Patchogue River, and thence 8 feet deep and 100 feet wide up the Patchogue River to Patchogue, at an estimated cost of \$66,000, and \$2,000 annually for maintenance.

In the opinion of Major Ruffner, concurred in by the division engineer, Col. G. L. Gillespie, Corps of Engineers, the channel from Fire Island Inlet to Patchogue is worthy of improvement by the United States to the extent of the foregoing estimate.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF FIRE ISLAND INLET, IN GREAT SOUTH BAY, TO PATCHOGUE RIVER, NEW YORK, WITH A VIEW TO OBTAINING A CHANNEL NOT LESS THAN 10 FEET IN DEPTH AND 200 FEET IN WIDTH AT MEAN LOW WATER.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., August 20, 1900.

GENERAL: The following report is submitted of a preliminary examination of "Fire Island Inlet, in Great South Bay, to Patchogue River, with a view to obtaining a channel not less than 10 feet in depth

and 200 feet in width at mean low water," in compliance with Department letter dated June 13, 1900.

The examination was made on the 9th of August, through the courtesy of Messrs. E. Bailey & Sons, of Patchogue, the firm most interested in the proposed improvement. They supplied a small stern-wheel steamer used by them for tugging and lightering from vessels to their wharves in Patchogue River when the draft is too great to allow them to enter the river. This steamer took us to the inlet, and, following the channel, frequent soundings were taken.

The pilot evidently knew the depths very well, and pointed out the shoals, calling off the expected depth with great accuracy every time. The office chart of the bay furnished by the Coast and Geodetic Survey was at hand and was seen to be essentially correct, there being no reason for marked changes in depth or shifting of channel in the bay.

The subject of this improvement has been partly considered by my predecessor, the late Lieut. Col. W. H. H. Benyaud, in his report of September 19, 1899 (House Doc. No. 133, Fifty-sixth Congress, first session¹), wherein he examined the question of an 8-foot channel over the same route. This is, however, a different question, and the reasons that led Colonel Benyaud to report adversely do not affect this examination. The commerce of Patchogue River was reported as aggregating 13,325 round trips of various vessels in the calendar year 1898, with an aggregate tonnage in all trips of 335,750. In a second report on the examination of "Patchogue River, with a view of securing a channel 10 feet deep at low water and 100 feet wide into the Great South Bay," by Colonel Benyaud, under date of September 19, 1899, in House Doc. No. 171, Fifty-sixth Congress, first session,² the proposition is again discouraged of attempting to secure a channel of those dimensions; but later, under date of December 4, Colonel Benyaud approved of the modification of the channel to 8 feet in depth by 100 in width.

The estimated cost of such improvement was \$19,550 and an annual cost of \$2,000 for maintenance. Colonel Benyaud then states that the commerce in the river had increased from 56,000 tons in 1890 to 255,200 tons, with a value of \$3,702,000, in 1898.

A list of vessels running to the port was given, with 35 names, drawing from 7 to 12 feet. A map accompanies the report, prepared from a survey of 1897, and this is printed with the document. It is now reported that the increase in commerce continues, both in trips and in tonnage, and that for the calendar year 1899 a total of 348,000 tons of tonnage entered the river, the freight aggregating 266,800 tons, at an estimated value of \$3,808,500.

A number of vessels, all small, are repaired or built at Patchogue for fishing and pleasure purposes. The following is a list of vessels using the channel from Patchogue to Fire Island Inlet, with reported draft and commercial statistics for Patchogue for 1899.

¹ Reprinted in Annual Report of the Chief of Engineers for 1900, Part II, page 1443, et seq.

² Reprinted in Annual Report of the Chief of Engineers for 1900, Part II, page 1446, et seq.

	Feet.		Feet.
Franconia	10	Levi Harris	8
Geo. A. Pierce	10	Grace Bailey	8½
Wm. T. Parker	9½	Anna Brown	8
J. Dallas Marvil	9	Emma Overton	7
Magie	8	Hettie J. Dorman	8½
Mary S. Ewing	8	Addie Sawyer	11
Jane Harris	7½	E. Waterman	12
Hickory	7	Terrapin	11
M. G. Suydam	7	Florence A. Davenport	10½
F. G. French	11	J. M. Haynes	11
Carrie C. Ware	10½	Mary E. Olys	10½
Nellie Eaton	10½	J. S. Terry	9½
Wm. H. Davenport	11	Geo. A. Howes	9
Maggie Ellen	10	B. F. Jayne	7½
Douglas Haynes	11	Ida C. Schoolcraft	10
Chas. H. Trickey	10½	Sally P. Beswick	7
Jno. Cadwalder	11	Puritan	10
Julia A. Berkele	9½	Cherubim	7
Mary E. Lynch	10	Sally Russell	6
Jennie D. Bell	9	Hattie M. Bird	6
Frank S. Hall	9	Mary A. Fisher	8

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1899.

Arrivals and departures of vessels.

[Draft, 2 to 9 feet; tonnage, 8 to 350 tons.]

Class.	Number of round trips.	Aggregate tonnage of all trips.
Steamers	1,350	78,000
Sailing vessels	7,600	100,000
Barges	4,600	170,000
Total	13,550	348,000

Vessels over 6 feet draft can not come into the river without lightering.

Freight received and shipped by water.

Class.	Tons.	Estimated value.
Received:		
Coal	13,500	\$67,500
Lumber	160,000	1,900,000
Miscellaneous	26,000	156,000
Shipped:		
Lumber	53,500	1,400,000
Fish and shellfish	5,300	160,000
Miscellaneous	8,500	125,000
Total	266,800	3,808,500

Vessels built and repaired, 1899.

	Number.	Tons.
Vessels built during 1899	55	2 to 70
Vessels repaired during 1899	450	2 to 300

No new lines of transportation reported established since July 1, 1899.

Great South Bay is a body of water on the south side of Long Island. It is some 30 statute miles long from its eastern end to where it changes its name to South Oyster Bay. It is about $5\frac{1}{2}$ statute miles wide in its greatest extent, opposite Fire Island Light, to the shores of the villages of Bay Shore and Islip; its area is about 101 square miles. While it is generally shoal, there is a central basin about 21 statute miles long, with a depth gradually increasing from 6 feet to 10 feet, with some small areas with 12 and as much as 15 feet in depth, all at low water.

For a distance of about 10 miles there is a basin with 10 feet depth, quite regularly even and flat, sometimes deeper, but not shallower, from a point about abreast of Patchogue River to a point about abreast of what is called Champlins Creek and a mile east of what is called Great Cove, which is the entrance to Islip and Bay Shore. There is no part of the south shore of Long Island more developed than this region, which is one continuous succession of villas, country places, villages, and summer resorts. Aside from the natural use of Great South Bay for oyster culture and for fishing, there is great use made of the region for pleasure purposes, sailboats and small yachts and fishing boats being found in great numbers. At the time the preliminary examination was made no less than 80 different craft, big and little, were in sight by actual count from the vicinity of Fire Island Inlet. No business is so profitable as a well-developed excursion and summer travel, and immense sums are expended in summer resorts, in pleasure visits, amusements, and sojourns in every available vicinity of the metropolis. To consider this commerce and to cater and provide for it is as justifiable as to contemplate tonnage alone. The carriage of thousands of human beings is much more profitable than to convey hundreds of tons of freight. Such a business is not to be measured by records of freight received and shipped, but by number of craft used, their value, and capacity. At the same time it is to be noted that summer resorts make villages, villages invite general commerce and encourage manufactories, and freight and heavy draft vessels go, when they can, to such places.

At Babylon, Bay Shore, Islip, Great River, Oakdale, Sayville, Bayport, Patchogue, and Bellport freight can now be brought by water in this manner. A schooner may load to a draft of 12 feet and enter Fire Island Inlet.

Passing up the channel, deep water will be found to a distance of about 7 miles, or near Point of Woods. Coming to an anchor, the vessel would be partly unloaded until, drawing about 8 feet, it would be possible to pass over three shoals which have about 8 feet on them at low water. Having crossed these the vessel would be able to enter the central basin, having a least depth of 10 feet, and could go about 8 miles farther, or to within about 2 miles of Patchogue. Manifestly, the removal of the three shoals spoken of would not only benefit commerce intended for Patchogue, but also any intended for all points not far from this central 10-feet-deep basin; i. e., from Bay Shore to Bellport.

This feature makes the difference between an examination to secure a depth of 10 feet and one to secure a depth of 8 feet to Patchogue. It naturally divides the subject into two parts. Dredging a channel through these three shoals would be equivalent to opening a 10-foot channel toward Patchogue some 8 miles long, and is manifestly a dif-

ferent thing from continuing that channel into the river itself. The channel thus secured might prove of more use than is now clearly seen, because the other villages might take advantage of a condition which brought vessels with as much draft as 10 feet so much nearer their doors. Every additional foot in draft of a coasting schooner means a considerable increase in capacity.

Conditions in the bay should be quite stable; there are no marked shoals; the change from shore to center is gradual. The depth is not great enough anywhere to permit of the generation of waves of great destructive power. The greatest depth being only from 13 to 15 feet, there is no likelihood that a channel as deep and as wide as proposed (200 feet at bottom, 11 feet deep, side slopes $\frac{1}{2}$ horizontal to 1 vertical) would be affected by such storms as might arise. The conditions would be different in a shallower channel, say 6 to 8 feet, on the bay shores, where the waves of translation coming from the central deeper water might easily fill up such a shallow trench. Frail structures on the shores of the bay are easily injured, and although ice accumulates at times and does injury to the shores, it can not do damage to a deep channel.

All conditions point to the desirability of a deep, wide channel for permanence.

The charts of the Coast and Geodetic Survey indicate quite closely the probable amount of dredging necessary to secure such a channel as is suggested through the shoals from Point of Woods to the central basin. From these it is estimated that about 50,000 cubic yards should be removed to obtain the depth and width intended. If a more accurate survey be desired, it could be made from funds on hand of the unexpended balance of former appropriations for the improvement of Patchogue River, at a cost of about \$450. I deem the locality worthy of improvement by the United States and recommend that the survey be authorized.

From Patchogue to the depth required in the bay we have data sufficient to make an estimate of cost. The change in depth here is so regular that the limit of error possible is slight.

It might be desirable to recommend a variation in depth of channel when the vicinity of Patchogue is reached. Vessels drawing 10 feet, reaching within 2 miles of Patchogue, might be lightered some 2 feet and then enter on a draft of 8 feet, and there would be a great saving. I am not prepared to state as to this as yet, until the survey of the outer shoals is finished. To secure a channel of 10 feet depth, 200 feet wide to the entrance and 100 feet wide above, into Patchogue River would require the dredging of about 400,000 cubic yards through a distance of some 2 miles in the bay and 1 mile in the river.

To secure a channel of only 8 feet depth into the river would require the dredging of 85,000 cubic yards, the width being only 100 feet. This is the estimate submitted by my predecessor. The present examination does not call for an estimate reaching into the river, but the whole matter would not be intelligible should the report stop at the river entrance; hence I shall consider the requirement to be not only to the entrance, but to the wharves. Outside the river the width should be greater than 100 feet, and if 200, then the estimate for an 8-foot channel is to be increased to 130,000 cubic yards. This difference between 400,000 cubic yards and 130,000 cubic yards is so great that an adherence to the greater one might completely invalidate the whole

idea of the improvement; hence I have thought it advisable only to consider the channel of 8 feet depth from the central 10-feet-depth basin to and into the river, knowing that, should commerce demand it, the channel could later be deepened.

With this explanation, I report that the improvement is one that should be undertaken by the United States, and recommend that a survey be made of the shoals between the central basin and the Fire Island Inlet.

The entrance to Fire Island Inlet is so narrow and crooked that the tidal flow is greatly contracted. Doubtless, were a system of jetties properly placed and the channel dredged, the entrance could be made much wider and the tidal inflow much increased, resulting in a subsequent deepening of the entrance to much greater dimensions than at present, the whole to the betterment of the bay and its commerce. This is not before us now, but it can do no harm to speak of the possibilities of such a project.

I inclose a copy of Coast Survey chart¹ of the Great South Bay, with the proposed dredging through the three lower shoals marked with red lines and the entrance to Patchogue River with one long red line.

Respectfully submitted.

E. H. RUFFNER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, August 22, 1900.

Respectfully forwarded to the Chief of Engineers, concurring in the recommendation of the district officer regarding a survey between the central basin of South Bay and the Fire Island Inlet.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 28, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Fire Island Inlet, in Great South Bay, to Patchogue River, New York (full text of item quoted within), required by the provisions of the emergency river and harbor act of June 6, 1900.

The local engineer is of opinion that improvement of the channel from Fire Island Inlet to the central basin in Great South Bay to a depth of 10 feet and width of 200 feet is a work worthy of being undertaken by the General Government, and he recommends that a survey be made with a view to preparation of plan and estimate of cost of such improvement. He is also of opinion that the locality between the

¹ Not printed.

central basin and the Patchogue River and thence up to the wharves at Patchogue is worthy of being improved, possibly to the extent of securing a channel, say, 8 feet deep, with width greater than 100 feet outside the river and of 100 feet inside.

Inviting attention to the views of the division engineer, in preceding indorsement, I recommend that a survey be authorized and plans and estimates of cost be prepared in accordance with the views of the local engineer, from the results of which an opinion may be formed as to the extent of improvement that may be justified by the commerce involved.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
August 30, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

SURVEY OF FIRE ISLAND INLET, IN GREAT SOUTH BAY, TO PATCHOGUE RIVER, NEW YORK.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., November 14, 1900.

GENERAL: In compliance with instructions contained in letter from the Chief of Engineers dated September 1, 1900, I have the honor to submit the following report upon a survey, with plan and estimate prepared, to comply with the terms of the river and harbor act approved June 6, 1900.

The survey consisted principally in sounding the three shoals mentioned in my report upon preliminary examination dated August 20, 1900, lying between the central basin of Great South Bay and Point of Woods, Fire Island, to which point, a distance of 7 miles, the deep channel in through Fire Island Inlet extends. The report upon preliminary examination contains a full description of the body of water now under consideration. Soundings were also made throughout the remainder of the water route followed by pilots from Point of Woods to Patchogue to verify the depths shown on the United States Coast Survey map, which is used as the basis of this survey, but no attempt has been made to correct the chart outside of the limits of the channel.

The results of the survey are exhibited on the accompanying map.¹ The general map of Great South Bay is copied mostly from a map furnished this office by the Superintendent of the United States Coast and Geodetic Survey on September 8, 1899, and below are shown the shoal areas sounded on a larger scale, with their location shown on the general map outlined by a broken line and lettered to correspond.

The mean range of tides at Patchogue and at the bars sounded is 1 foot.

¹ Not printed.

No improvement has ever been made in Great South Bay by the United States. Patchogue River was improved by dredging and jetty construction under a project commenced in 1890 and completed in 1897, so as to make the channel about 60 feet wide and 6 feet deep at mean low water, at a total cost of \$40,000. Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, Part I, page 1108.

The areas to be dredged to secure depths of 10 feet, mean low water, from Fire Island Inlet to the central basin in Great South Bay, and 8 feet into Patchogue River to Patchogue, are shown on the accompanying map, outlined and shaded in red. The estimates are designed to cover the work necessary to make the channel of the depths named from Fire Island to Patchogue, to be 200 feet wide to Patchogue River, and 100 feet wide in the river.

Estimates.

Dredging in Great South Bay, between Fire Island Inlet and the central basin, 170,000 cubic yards of material, at 20 cents per cubic yard.....	\$34, 000
Dredging from the central basin to Patchogue, 130,000 cubic yards of material, at 20 cents per cubic yard.....	26, 000
Contingencies, supervision, etc., 10 per cent.....	6, 000
Total	66, 000
Annual maintenance	2, 000

In case it is determined to carry the 10-foot channel clear in to Patchogue the estimate in addition to the above is:

Dredging 270,000 cubic yards of material, at 20 cents per cubic yard.....	\$54, 000
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From information received from reliable sources it appears that the commerce of Patchogue River has increased from 56,000 tons, with a value of \$650,000, in 1890, to 266,800 tons, with a value of \$3,808,500, in 1899.

Commercial statistics for Patchogue River, in tons, as shown by comparison since 1890, are as follows:

	Tons.		Tons.
1890	56, 000	1896	143, 500
1892	120, 000	1897	250, 000
1893	125, 000	1898	255, 200
1894	145, 000	1899	266, 800
1895	129, 485		

The commerce reported for 1899 was as follows:

Freight received and shipped by water.

Articles.	Tons.	Estimated value.
Received:		
Coal.....	13, 500	\$67, 500
Lumber.....	160, 000	1, 900, 000
Miscellaneous.....	26, 000	156, 000
Shipped:		
Lumber.....	53, 500	1, 400, 000
Fish and shellfish.....	5, 300	160, 000
Miscellaneous.....	8, 500	125, 000
Total.....	266, 800	3, 808, 500

Vessels engaged in above commerce.

[Draft, 2 to 9 feet; tonnage, 8 to 350 tons.]

Class.	Round trips.	Aggregate tonnage of all trips.
		<i>Tons.</i>
Steamers.....	1,350	78,000
Sailing vessels.....	7,600	100,000
Barges.....	1,600	170,000
Total.....	13,550	348,000

Vessels built and repaired in 1899.

	Number.	Tonnage.
		<i>Tons.</i>
Vessels built.....	55	2 to 70
Vessels repaired.....	450	2 to 300

The above figures show an increase in freight over the amount reported for 1898 of 11,600 tons.

List of vessels running to Patchogue River through Great South Bay.

Name.	Tonnage.	Name.	Tonnage.
	<i>Tons.</i>		<i>Tons.</i>
Agile.....	15	Benlah Potter.....	11
Annie May.....	11	Bertie Bransford.....	11
Alida V.....	11	Blanch Morgan.....	39
Annie May.....	18	B. F. Jayne.....	117
Addie G.....	11	Belle Breckenridge.....	21
Arthur Leland.....	11	Black Hawks.....	85
Annie Florence.....	14	Belle Seaman.....	165
Arthur B.....	14	Bredell.....	63
Advance.....	18	Bay Shore.....	111
Agnes K.....	11	Cheetah.....	12
Alida Wood.....	11	Chas. E. Rose.....	11
Anna St. Clair.....	11	C. H. Green.....	20
Adelia.....	11	Clara Cummin.....	14
Avocet.....	21	Clio.....	11
Annie V.....	11	Caddie V.....	11
Argyle.....	9	Chas. F. Dayton.....	14
Artemesia.....	17	Cruesoc.....	17
Annie E.....	12	Cecelia.....	11
Alice M. Newton.....	9	Clara.....	9
Annie.....	9	Carrie H. T. B.....	11
Annie.....	11	Cecelle.....	11
Anna Maria.....	26	C. W. Baker.....	9
Alice.....	9	Chetotalk.....	14
Advance.....	11	Carl E.....	11
Aletta.....	14	Carrie Potter.....	11
Adelia Ockers.....	11	Carola.....	9
Annie Bell.....	11	Carrie M.....	11
Alpha.....	14	C. H. Green.....	24
Agile.....	15	Comfort.....	18
Annie S. Carl.....	72	Columbia.....	20
A. & A. Reeves.....	80	Cygnets.....	11
Annie G.....	35	C. P. Hoffman.....	62
Annie Brown.....	72	Chas. Green.....	27
A. F. Harmor.....	33	Curlew.....	37
Anna Brown.....	120	Chetonark.....	12
A. M. Smith.....	36	Commodore.....	38
Aurora.....	53	Chas. Wall.....	33
Ann Augusta.....	36	Chas. Dayton.....	14
Ada M. Hallock.....	44	Charlie Banks.....	69
Alfred T. Kemp.....	60	Cinderella.....	86
Bay Queen.....	30	C. B. Simpson.....	32
Brunhilde.....	11	Curiosity.....	59
Ben Russell.....	11	Connetquot.....	63
Betty E.....	11	Claudia V.....	33
Bernice H. Odell.....	11	Charlie Zank.....	65
Bessie.....	11	Coming.....	47

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List of vessels running to Patchogue River through Great South Bay—Continued.

Name.	Tonnage.	Name.	Tonnage.
	<i>Tons.</i>		<i>Tons.</i>
C. E. Homan	24	Francis	15
Daisy	9	Flossie	23
Defiance	12	Fanny	45
D. S. S. Sammis	9	Four Brothers	21
Daniel H. Egbert	27	Flying Arrow	75
Dulywich	12	Gracie & Emily	15
Duchess	14	Gussie B. Spaulding	11
Dite	12	Galilee	17
Ditto	9	G. Bransford, Sr	9
Deborah T. Hill	56	Gracie	11
Eloise Lord	9	Guss	11
Elisha Saxton	14	Governor Cook	9
Eagle	15	Grace L	30
Ellen M. Miller	30	Grace	23
Ella	12	George Ryder	32
E. E. Smith	9	General Grant	12
Emma R	14	Gilbert Hirsch	17
E. Lane	9	G. S. Dunbar	11
Ethel R	9	Greyhound	14
Edward Westerbeke	15	Geo. A. Shaffer	12
Eastport	12	Gerard Underhill	21
Ethel	14	Georgie M	9
Eclipse	50	George Bishop	9
Edna B	12	Georgia O	11
Emma	9	Growler	15
Eloise	11	George Ross	9
Edith S	12	George Kingston	18
Edith M	9	Gladys G	11
Emma M	11	Goldenrod	15
Euphemia Purton	9	G. P. Wright	147
Euphemia	29	Grace Bailey	102
Eunice	11	Gen'l Levi Harris	71
Emma Crum	9	Geo. F. Carman	54
Edna H. Hulse	11	Gazelle	42
Etta S	9	Geo. W. Raymond	44
Estelle Gerber	11	Governor Cook	8
Excelsior	11	Gracie Young	9
Ella A	17	Gilbert	23
Edward Preston	11	H. K. Roe	11
Eliza Snediker	9	Helene	24
Electra	26	Harold K	14
Elizabeth A. Bedell	21	Hunter	11
Emma White	50	Hattie F. Burcham	11
Edwin Bailey	525	Henry D. Simonson	30
E. Bailey & Sons	60	Henry Ruppell	12
Edw. Dickerson	50	Halcyon	11
Ella Cooper	62	Hustler	14
E. S. Dickerson	90	Hattie S	9
Emma Jane	38	Henrietta Bransford	12
Ella Bell	32	Hattie M. Bird	27
Eureka	27	H. F. Hildebrandt	9
Emma Overton	69	Hempstead	9
Ellen M. Miller	30	Homet	12
E. T. Moore	36	Harry D. Hazard	9
Ella Robbins	39	Helyn	11
Evelene	33	Honest	9
Escort	30	Hope Haynes	324
Emma Arthur	33	Hickory	41
Eliza Scyvenas	33	Howard John	46
Ellen Burr	32	H. J. Bishop	32
Enterprise	32	Hesperus	38
Eloise Lord	8	Henry D. Brewster	59
Empress	14	Hemlet	35
Emily Baxter	175	Henry Middleton	102
Emma Bird	14	Harry Doremus	68
Eva D. Rose	225	H. V. Duryea	75
Flyaway	14	Henrietta	42
Filmore A. Baker	9	Hallie	44
Fannie	11	Harmond	30
Frolic	12	Harold J. McCarty	468
Fannie Fern	11	Idler	12
Florence Ward	11	Inner Beach	14
Franklin Broell	14	I Take It	11
Frank A. Baker	9	Isabel	11
Florence Cox	9	Island Queen	21
Fannie W	9	Ida M. Prout	11
Florence B	12	Ingonish	11
Fannie	12	Ida G. Broere	9
Farmers Friend	21	Impatience	17
Farmer	11	Ida Thayer	63
Fannie B	11	Ida B. Silsbe	66
Francis P. Smith	9	Ilo	61

List of vessels running to Patchogue River through Great South Bay—Continued.

Name.	Tonnage.	Name.	Tonnage.
	Tons.		Tons.
Klondike	17	Jennie Wicks	9
King Fisher	12	J. H. Still	30
Katie Marie	21	James Morrissey	27
Ki st Carson	23	Joseph H. Seguire	29
Kennebeck	281	John Henry	24
Katie C	11	Jacob Ockers	21
Kamoor	54	Joseph Hart	14
Olive Branch	14	Jennie	9
Oysterman	23	Josephine	14
Oscar	9	J. S. Terry	186
Ollie	29	Jas. Garfield	96
Orion	18	Jas. Paterson	71
Oak Island	30	J. W. Boyle	93
Ocean Spray	9	J. S. Pettio	39
Lydia	17	James Parker, sr	159
Louisa	11	Jennie Brown	36
Laura E.	11	Jno. Cornwell	35
Loretta	9	J. W. Stout	59
Lilliella	9	Jno. W. Broomall	42
Laura F.	17	Jordan	38
Lillie Dean	12	John Howard	47
Libbie D	12	Jane C. Harris	63
Libbie W	9	Josephine	47
Lavinia	9	J. T. Hoffman	63
Lieutenant	25	J. Daggett	14
Lue Ockers	11	Jesse G.	9
Lida F. Price	14	Justine	11
Lillie B. Dayton	11	Jessie Barlow	394
Laura Elsie	9	Reliance	11
Laconce	30	Reginald	11
Lawrence J	30	Rosie	12
Lizzie B.	9	Rival	9
L. V. Ostrom	75	Rosella	14
Lucy Bell	32	Rosa Bell	30
L. R. Hand	23	Red Cedar	12
Lillie Ernestine	80	Regina	11
Laconia	29	Richard Rhodes	29
Lizzie Morse	30	Robert Mills	25
Lizzie Lane	29	Robert Felter	63
Lewis B. Baker	51	Rebecca M.	33
Leo	80	Reindeer	135
Lottie N.	35	R. Mason	75
Louis Monette	165	Romana	38
Louis Doigler	8	Ridgeway Park	65
Lisa Hall	14	Rosalie	9
Louisa R	11	Minnie V	11
Nememsis	14	Mist	11
Nellie Hayes	11	Marguerite B	11
Nettie	9	Madeline Sammis	9
Nightmare	9	Minneola	12
Natahe Lucas	11	Maud S	12
Nesttie Bell	15	Mary Ella	11
Norma	11	Modoc	11
Nianta	12	Mildred A	14
Nellie Handy	9	Maggie May	12
Norman	11	Madaline Brandt	9
Nettie Green	9	Marina B	11
Nellie	12	Mergus	20
Pioneer	9	Mabel A	27
Perry Belmont	11	Marine G	11
Phebe Cochran	14	Mary Beebe	9
Pearl	9	Mary E. Combs	21
Pansy	12	Montauk	9
Paul Raymond	14	Martie E.	9
Painte	17	Maud Moller	11
Peri	21	Macy	30
Patience	15	Mary M. Broere	11
Punch and Judy	11	Madeline	17
Priscilla	15	Mosquito	38
Point o' Woods	42	Marie Rose	18
Phebe Ann	45	Mary and Ella	11
Pulaski	89	Mamie and Kittie	11
Jennie Ockers	11	Mary E. Olys	310
J. T. Housman	12	Mabel Josephine	11
Jennie Tucker	11	Madge	11
James Crocker	9	Mystery	11
Jap	26	Moe Mitchell	12
Jerry Brown	12	Mamie B.	9
J. B. Ford	15	Maggie	12
Jno. W. Bailey	9	Mamy Rosa	9
James Humphrey	15	Margaret	30
Jennie McFarline	15	Mary J. Sampers	12

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List of vessels running to Patchogue River through Great South Bay—Continued.

Name.	Tonnage.	Name.	Tonnage.
	<i>Tons.</i>		<i>Tons.</i>
Milton Leon	14	Sarah Craig	38
Mabel Jewell	11	Sophia Behrman	69
Mabel	12	Shawondasse	48
Maid of the Mist	9	Sommerheim	56
Maud V. Jones	9	Samuel Burns	30
Mary Helen	81	Skip Jack	8
Minnie Still	83	Sea Gull	9
M. L. Curtis	42	Spare Time	14
M. R. Drew	42	Twin Bros	14
Morning Light	20	Triton	12
M. E. Mills	66	Tryne Kahler	15
Mary A. Fisher	174	Two Sisters	17
Mary Wood	51	Two Sisters	11
Mary E. Lynch	278	T. O. Smith	83
M. E. Suydam	37	Tuttle Dayton	54
Magic	72	Theo. Fletcher	60
Mary A. Brown	53	Thos. Fletcher	36
Myrtle	41	Turtle	56
May Flower	42	Thos. B. Aston	27
McKnew	78	Tessie Carman	12
Milo	72	Urica	18
Quo Vadis	24	Una	14
Sergeant	12	Union	15
Skipjack	9	Uncle David	9
Selina	9	United States	9
Sagitta	12	Vindicator	12
Susie R	15	Victor	23
Sam'l C. Wicks	12	Veroqua	14
S. V. Rogers	11	Veto	11
Susie B.	11	Veronica	14
Sara H. Blaiidsell	18	Virginia	21
Sarah Ellsworth	30	Viva Bransford	15
Sarah E.	20	V. Koon	33
Sam Ludlow	20	Wilhemina	9
Sarah McCune	20	W. L. V.	9
S. F. Burns	27	Wallie A. Silsbe	11
Sadie A	9	White Star	9
Sparkle	11	Walter S. Lawrence	26
Sea Lark	11	William H. Rowe	27
Sadie	9	Wilbur D	17
South Side	11	Whim	12
S. F. Knapp	11	Wanderer	11
Sadie M.	23	W. S. Biggs	17
Sharp Shooter	81	Wm. H. Sharp	11
S. W. Truslow	35	Wave	11
Samuel Wood	77	William T. Parker	267
Sally Russell	63	Wilford W. Tullee	33
Sea Bird	17	W. R. Roberson	8
Senekes	60	Wanda	15
Silver Spray	36	Water Lily	14
Sidney Munsell	71	Wa Wa Yanda	20
Sarah Jane	144	Zepher	20

Total, 524 vessels, aggregating 16,955 tons.

List showing draft of certain vessels using Patchogue River.

Name.	Draft.	Name.	Draft.
	<i>Feet.</i>		<i>Feet.</i>
Franconia	10	Mary E. Lynch	10
Geo. A. Pierce	10	Jennie D. Bell	9
Wm. T. Parker	9½	Frank S. Hall	9
J. Dullas Marvil	9	Levi Harris	8
Magic	8	Grace Bailey	8½
Mary S. Ewing	8	Anna Brown	8
Jane Harris	7½	Emma Overton	7
Hickory	7	Hettie J. Dorman	8½
M. G. Suydam	7	Addie Sawyer	11
F. G. French	11	E. Waterman	12
Carrie C. Ware	10½	Terrapin	11
Nellie Eaton	10½	Florence A. Davenport	10½
Wm. H. Davenport	11	J. M. Haynes	11
Maggie Ellen	10	Mary E. Olys	10½
Douglas Haynes	11	J. S. Terry	9½
Chas. H. Trickey	10½	Geo. A. Howes	9
Jno. Cadwalder	11	B. F. Jayne	7½
Julia A. Berkele	9½		

In view of the increase in commerce, and of the fact that the depth of water is insufficient for the vessels which use it, I am of the opinion that the channel from Fire Island Inlet to Patchogue is worthy of improvement by the United States to the extent of the foregoing estimate.

Very respectfully, your obedient servant,

E. H. RUFFNER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[Third indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, November 22, 1900.

Respectfully returned to the Chief of Engineers, concurring in the recommendation of the district officer for an improvement providing for a channel through Great South Bay 200 feet wide and 10 feet deep, and into Patchogue River a channel 100 feet wide and 8 feet deep, at an estimated cost of \$66,000, with an annual maintenance of \$2,000.

The tonnage of this waterway has increased from 56,000 tons, having a value of \$650,000, in 1890, to 266,800 tons, with a value of \$3,808,500, in 1899.

In my opinion the harbor and river are worthy of improvement to the extent of the estimate stated.

G. L. GILLESPIE,
*Colonel, Corps of Engineers,
Division Engineer.*

F 35.

ESTABLISHMENT OF HARBOR LINES IN PORT CHESTER HARBOR AND BYRAM RIVER, NEW YORK.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., February 12, 1901.

GENERAL: In compliance with the indorsement of the Chief of Engineers dated September 13, 1900, on petition of citizens, riparian owners of Port Chester, N. Y., and East Port Chester, Greenwich, Conn., for establishment of harbor lines in Port Chester Harbor and Byram River, with my letter of transmittal dated September 8, 1900, I have the honor to report that without making an entirely new survey I have had a chart prepared from a final examination made in October, 1900, of work under improvement, which shows the present condition of the harbor and river and the location of the harbor lines now proposed.

Under date of December 26, 1900, a hearing in the matter of establishment of harbor lines was announced by sending a notice¹ (copy herewith) to each of the petitioners and to other riparian owners so far as known, and by posting notices in the post-offices and on the

¹ Not printed.

legal or public posts of Port Chester and East Port Chester, or Greenwich, so called.

Suggested lines were placed on the map which was exhibited at the meeting, and such modifications in the lines as appeared to be necessary and advisable were made by me in the presence of the parties interested. So far as learned from a general canvass there are about 48 riparian proprietors owning the shores of the river and harbor. Of these, 37 were present at the hearing; two known to be interested and not present were interviewed, and two have submitted their opinions in writing (letters¹ herewith), from which it appears that the parties do not understand the object of the establishment of harbor lines. This leaves seven who are not on record, but most of whom, from reliable authority, are owners of small lots on the east side of the road running along the river and do not appear to be especially interested in the matter. A very free discussion of the matter took place at the hearing, and so far as known all objections were met and the line as now shown was concurred in. The names of the persons above enumerated are as follows:

PRESENT AT HEARING JANUARY 10, 1901.

Residents of Port Chester, N. Y.: William J. Ryan, Capt. E. F. Studwell (Port Chester Transportation Company), Capt. H. D. Pausch, Capt. C. H. Davis, C. S. Lyon, James W. Lounsbury & Son, William Gould (representing Adelaide S. Gould), E. F. Furrer and C. R. Furrer (Fox Island), J. M. Sherman, F. A. Taylor, M. L. Taylor, Capt. Henry Peters, F. S. Odell, W. L. Ward, Amos Morrell, Alva A. Lyon, Newman Holly, Daniel P. Townsend, Nathan Parker, N. Hubbard, Frank Taylor, C. H. Tibbetts, John F. Mills (for Abendroth Brothers), Samuel Cromly, John Ryan, Captain Davis.

Residents of Greenwich, Conn.: Frank M. Berrien (for Mrs. Eliza Berrien), Harry Martin, Chester Martin, George Martin, Henry Merritt, John Merritt, Frank Mertz, George Mertz, William Wessell (Wessell Brothers), H. F. Parker.

NOT PRESENT AT HEARING.

Owners of shore property in Connecticut and New York: Charles Mallory (steamship line, Pier 20, New York City), Henry Mallory (steamship line, Pier 20, New York City)—above two persons were interviewed at their offices in New York; M. Willett (estate of Byram Point property), Martin Kapp, Augustus Parks, F. A. Bryan, C. R. Orrick, J. Vaughn, estate of William Purdy.

On the upper portion of the harbor is a system of docks built for many years and in general use for a thriving business. These docks were built by laying stones without cement for dock walls on such bottom as could be got without the use of the dredge, and in a few cases resting on the rock. In some cases walls of houses are on or near these dock fronts. The intention of the builders has always been that these docks should be built as cheaply as possible and at the same time serve a class of boats that were smaller than can now use the harbor since the deepening of the channel by the United States. In order not to cramp the harbor too much, it being very narrow, I have thought it best to have these dock lines as they are now recognized as permanent bulkhead lines, and at the same time it was my wish to have them established as pierhead lines. But, since vessels drawing more water than formerly now come into the harbor, dock owners wish to build pile docks in front of their stone ones to meet the dredged channel. The dredging could not be carried close to the stone wharves,

¹ Not printed.

for in that case they would have been carried away. Hence we kept the edge of the new channel at a distance of at least 15 feet from these wharves. After a somewhat prolonged discussion of the situation, in reply to the request of the owners to be permitted to carry their wharf fronts out to the new channel, I compromised, and they accepted the proposition that they be allowed to build in front of their stone wharves, which should be retained as the permanent bulkhead line, pile docks not to exceed 10 feet in width; or in other words, that the pierhead line should be 10 feet in front of the bulkhead line, where existing stone-dock fronts are found on the upper part of the harbor, as marked on the chart.

Over a part of the harbor are no docks now. In future it is proposed that all shall conform to the same lines as far as the lowest dock now in existence. Below that point the pier and bulkheads are to coincide, if my recommendation be accepted. In the expansion below the narrow part of the harbor are already some piers, and there is no reason for too much limitation as to future construction. On this part of the harbor the property owners have accepted the lines as proposed.

At present no property owner is known to object to the lines laid down, and many have been heard—the majority, in fact. The following is the general description of the proposed pierhead and bulkhead lines which are shown on the accompanying map:¹

On the west side of the river and harbor the bulkhead line is as follows: Beginning at the highway bridge at the head of navigation, the line follows the line of the face of the existing stone dock or wall of Abendroth Brothers to point A, shown on the map; at the highway bridge the distance between bulkhead lines on the east and west sides of the river is 130 feet; the distance between bulkhead lines at point A is 120 feet; thence in a straight line along the dock front to its intersection with the north line of Willett street, which is called point B; at this point the distance between bulkhead lines is 190 feet, measured on prolongation of north line of Willett street; thence straight to the southeast corner of the steamboat dock, called point C; thence along the line of the face of the steamboat dock and a prolongation thereof to its intersection with the dock front on the west side of the river, adjacent to the steamboat dock, called point D; thence in a straight line along the dock front to the southeast corner of the basin, called point D'; the distance between the bulkhead lines on a prolongation of the north line of the basin is 300 feet; beginning at the northeast corner of the dock of the estate of J. V. Peck, called point E; the distance between bulkhead lines at this point on a prolongation of the south line of the basin is 270 feet; thence in a straight line to the northeast corner of Park dock, called point F; the distance between bulkhead lines at this point is 220 feet, measured at right angles across the river; thence in a straight line to the northeast corner of Ryan dock, called point G; the distance between bulkhead lines at this point is 140 feet; thence following the face of the Ryan dock to its southeast corner, called point H; the distance between bulkhead lines at this point is about 141 feet; thence in a straight line until it intersects a line projected from the line of Bent's dock, called point I; the distance between bulkhead lines at this point is 130 feet; thence in a straight line along the line granted by permit of the Secretary of War to Russell, Burdsall, and Ward, July 2, 1890, to the northeast corner of Bent's dock, called point K; the distance between bulkhead lines at this point is 120 feet; thence along the face of Bent's dock to a point opposite the south line of Purdy avenue, called point L; the distance between the bulkhead lines at this point is 145 feet; thence in a straight line to the salient northeast point of land of the estate of William Purdy, called point M, at which point the distance between bulkhead lines is 135 feet; thence about 180 feet to the next lower salient point of land of estate of William Purdy, called point N; at this point the distance between bulkhead lines is 130 feet; thence deflecting toward the west and running a length of about 200 feet into an indentation or bay of the river, called point O; the distance between the bulkhead lines at this point is 160 feet; thence across the bay or indentation so called about parallel with the dredged chan-

¹Not printed.

nel to a salient point of land on the east side of Fox Island, called point P, at which point the distance between the bulkhead lines is 200 feet; thence a distance of about 240 feet to the next lower salient point of Fox Island, called point Q; at this point the distance between the bulkhead lines is 110 feet; thence in a straight line to its intersection with the line of dock permit to H. D. Pausch, dated August 29, 1900, called point R; the distance between the bulkhead lines at this point is 115 feet, and midway in the line last described the distance between the bulkhead lines measured across to Mallory's dock is 140 feet; thence from the last-described point the line follows the line of dock permit granted to H. D. Pausch August 29, 1900, and along the dock front of the town dock to its southeast corner, called point S; thence to the most southerly point at high-water mark at Fox Island, called point T; the distance between bulkhead lines at this point is 110 feet; thence to a point about 90 feet in a southwesterly direction about parallel with the channel, called point U; at this point the distance between bulkhead lines is 140 feet; thence in a straight line to the northeast corner of Davis dock, called point V; thence following the face of Davis dock to its southeast corner, called point W; thence in a straight line to the northeast corner of Gould's dock, which was built under a permit of the Secretary of War to Adelaide S. Gould, May 16, 1898, called point X; thence along the face of Gould's dock to its southeast corner, called point Y; thence in a straight line to the lower or southeast corner of the old steamboat landing, called point Z; thence in a straight line to the point of land on the west side of the entrance to the bay or inlet, at the southwest corner of the harbor, opposite to and about 360 feet from the high-water line of the west end of Manursing Island, called point A'.

On the west side of the river the pierhead line is as follows: Beginning at the highway bridge and running parallel to and distant 10 feet from the bulkhead line above described to the south line of Purdy avenue.

On the east side of the river and harbor the pierhead and bulkhead lines are identical, and are as follows: Beginning at the highway bridge at the head of navigation at a point 130 feet from the bulkhead line on the west side of the river and running along in a straight line to a point opposite and distant 120 feet from point A above described; thence along the face of the dock to a point opposite the north line of Highland avenue; the distance between the bulkhead lines at this point is 120 feet; thence in a straight line to a point opposite the north line of Willett street prolonged, and distant 190 feet from point B; thence in a straight line to a point 50 feet north of the prolongation of the north line of the basin lying between points B and E above described; thence to a line of wall to be built by Abendroth Brothers under permit of the Secretary of War dated December 20, 1897; this point is opposite point F, and the distance across to point F is 230 feet; thence following the line of stone wall authorized by the Secretary of War December 20, 1897, to Abendroth Brothers, to a point on the high-water line on the shore opposite the point I; thence in a straight line crossing the face of a small stone dock to an old stone dock opposite Bent's dock, or point K; thence in a straight line to a point opposite Purdy avenue, and on a prolongation of the south line of same; thence in a straight line to a point opposite M; thence in a straight line to a point opposite N; thence in a straight line to a point opposite O; thence in a straight line to the high-water line on shore opposite point Q; thence in continuation of the last-mentioned line until it intersects a line drawn from the northwest corner of the small dock opposite the town dock, across the face of Mallory's dock; thence in a straight line across the outer face of Mallory's dock to the northwest corner of the small dock opposite town dock and point S; thence in a straight line to a point on high-water mark on shore opposite to and between points S and T; this point is 110 feet distant from the line between S and T; thence in a straight line to a point opposite and 140 feet distant from point U; thence in a straight line about 280 feet and touching points on shore at high-water line; thence deflecting toward the east and extending in a straight line about 270 feet and tangent to the most westerly point of Byram Point; thence in a straight line tangent to the high-water line of the shore of Byram Point until it intersects the breakwater off Byram Point at a point about 520 feet measured inshore from the outer end of the breakwater.

The distances from east to west harbor lines not given in the description of the east line may be found in the description of the west line.

Very respectfully, your obedient servant,

E. H. RUFFNER,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 16, 1901.

Respectfully submitted to the Secretary of War.

Citizens of Port Chester, N. Y., having petitioned for the establishment of harbor lines in Port Chester Harbor and Byram River, the district engineer officer, Major Ruffner, has given the subject careful investigation and consideration. Riparian owners and commercial interests have been conferred with, and an opportunity afforded all parties to present their views.

In the within report Major Ruffner gives a full description of the lines he recommends for adoption, and the said lines are indicated on the accompanying tracing.¹

It appears that these lines are generally satisfactory to the interested parties, and I recommend their approval, and that the Secretary place his approval on this report and on the tracing which has been prepared for his signature.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,
February 18, 1901.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

PETITION OF MR. WM. RYAN AND OTHERS.

PORT CHESTER, N. Y., *August 15, 1900.*

DEAR SIR: The undersigned citizens of Port Chester, N. Y., and Greenwich, Conn., and owners of dock property fronting on Port Chester Harbor and Byram River, respectfully request that harbor lines be established along said river and harbor.

We therefore ask that at as early a date as convenient the necessary surveys be made and steps be taken to have this request granted.

Respectfully,

WM. RYAN [and others].

E. H. RUFFNER, Esq.,
Major, Corps of Engineers,
Army Building, New York City.

[Fifth indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, February 13, 1901.

Respectfully returned to the Chief of Engineers, concurring in the recommendations of the district officer contained in report of Feb-

¹ Not printed.

ruary 12, 1901, upon the "Establishment of Harbor Lines, Port Chester Harbor, N. Y."

G. L. GILLESPIE,
*Colonel, Corps of Engineers,
Division Engineer.*

F 36.

MODIFICATION OF HARBOR LINES ON EAST SIDE OF BRONX RIVER,
NEW YORK HARBOR, NEW YORK.

OFFICE OF THE
SOUND VIEW LAND AND IMPROVEMENT COMPANY,
Borough of the Bronx, New York, May 7, 1901.

DEAR SIR: Application of the Sound View Land and Improvement Company, in relation to change of the established pier and bulkhead lines on the easterly side of the Bronx River, southerly of Randall avenue.

The undersigned, owners of the plot of ground lying and fronting on the easterly side of the Bronx River, between Blackrock street and Grapevine street, as the same are laid out on the map or plan of the street system in that part of the borough of the Bronx lying easterly of the Bronx River, respectfully petition that the pier and bulkhead line on the east side of the Bronx River, as established by the New York Harbor Board and approved by the Secretary of War, January 9, 1891, be shifted easterly, in order to establish the width of the Bronx River between the pier and bulk head lines at about 400 feet, which will make said pier and bulkhead lines of the Bronx River coincide with those proposed by the board of public improvements of the city of New York.

This application is made to enable the petitioners to construct docks, without excessive dredging and excavating, which will be necessary if the pier and bulkhead line is kept in its present location.

A sketch¹ illustrating the above application is herewith submitted.

Respectfully,

JOHN J. BARRY,
Secretary Sound View Land and Improvement Company.

The honorable the SECRETARY OF WAR.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, June 22, 1901.

GENERAL: The New York Harbor Line Board has considered the application of the Sound View Land and Improvement Company for modification of pier and bulkhead lines on the easterly side of Bronx River, New York, referred by your indorsement of May 13, 1901, and has the honor to recommend that the existing harbor lines in the local-

¹ Not printed.

ity in question be modified as shown by a full red line on the accompanying tracing.¹ The line as thus recommended is substantially in accord with the bulkhead line proposed by the board of public improvements of New York City, as shown on the blue print which accompanies the papers in the case.

The following is a description of the modified line herein recommended:

Beginning at a point in the pierhead and bulkhead line approved by the Secretary of War January 9, 1891, on the northeasterly shore, at the mouth of the Bronx River, in the easterly prolongation of the north side of East Bay avenue, 600 feet from the pierhead and bulkhead line on the southeasterly shore, approved by the Secretary of War January 9, 1891; thence northwesterly on a curve with a radius of about 2,080 feet to a point in the easterly prolongation of a line passing through the point of curve on the pierhead and bulkhead on the southeasterly shore located by coordinates 14822.082 south, 20669.798 east, and the center of the curve located by coordinates 15315.757 south, 20202.161 east, and 500 feet distant from the pierhead and bulkhead line on the southeasterly shore; thence northwesterly on a curve with a radius of about 1,470 feet to a point in the northeasterly prolongation of a line passing through the point of curve on the pierhead and bulkhead line located by coordinates 14639.014 south, 20135.688 east, and the center of curve located by coordinates 15315.757 south, 20202.161 east, and 400 feet distant from the pierhead and bulkhead line on the southeasterly shore, approved by the Secretary of War January 9, 1891. The coordinates refer to the origin established by the board of public improvements at the northeast corner of Tenth avenue and Two hundred and twenty-fifth street.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.

S. M. MANSFIELD,
Colonel, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY, *June 27, 1901.*

Respectfully submitted to the Secretary of War.

The Sound View Land and Improvement Company requests the modification of the harbor line established by the Secretary of War January 9, 1891, on the east side of Bronx River, New York.

The application has been considered by the New York Harbor Line Board, which recommends in the within report that the existing line be modified as shown by full red line on accompanying tracing and described within.

I concur in the recommendation of the Board, and suggest that the Secretary place his approval both on this paper and the map which has been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

¹ Not printed.

[Second indorsement.]

WAR DEPARTMENT, *June 28, 1901.*

The recommendation of the Board, as concurred in by the Chief of Engineers, is approved.

E. ROOT,
Secretary of War.

F 37.

MODIFICATION OF HARBOR LINES IN HUDSON RIVER AT TROY, NEW YORK.

HOUSE OF REPRESENTATIVES,
Washington, June 14, 1900.

SIR: I inclose herewith a petition from property owners of Troy, N. Y., who own property adjacent to the Hudson River opposite the proposed improvements now about to be commenced in the channel of the river. These petitioners represent the most substantial citizens of Troy, and are large manufacturers and very largely interested in the manufacturing industries of the city. As appears by the petition, they desire to have the present pier and bulkhead line extended to near the proposed new channel, so that they may enjoy the benefits thereof.

The present bulkhead line is an irregular line, at some places being but 5 feet from the proposed channel, and at other points 90 or 100 feet distant therefrom. The plan is to make the new line regular and have it extend at the uniform distance of 5 feet from the proposed new channel. This proposed change will greatly benefit the property owners, and I urgently recommend that the prayer of the petition be granted.

Please have the matter speedily and carefully considered.

Respectfully,

A. V. S. COCHRANE.

The SECRETARY OF WAR,
Washington, D. C.

* * * * *

[Eighth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 26, 1900.

Respectfully returned to the Secretary of War.

Hon. A. V. S. Cochrane, M. C., incloses a petition from the citizens and property owners of the city of Troy, N. Y., requesting a modification of the pier and bulkhead line on the east side of the Hudson River at that place.

The subject has been under consideration by Col. J. W. Barlow, Corps of Engineers, who recommends that the line be modified as shown in orange on the accompanying tracing.¹

It appears from Colonel Barlow's report that the modification pro-

¹ Not printed.

posed will prove satisfactory both to riparian proprietors and the commercial interests, and I therefore recommend its approval.

The tracing has been prepared for the signature of the Secretary of War.

A. MACKENZIE,
Acting Chief of Engineers.

[Ninth indorsement.]

WAR DEPARTMENT,
July 27, 1900.

Approved as recommended by the Acting Chief of Engineers.

ELIHU ROOT,
Secretary of War.

PETITION OF MR. DANIEL E. CONWAY, MAYOR OF TROY, N. Y., AND OTHERS.

TROY, N. Y., *May 1, 1900.*

Greeting: Whereas your petitioners, who are residents of the city of Troy, N. Y., and owners of the uplands abutting on the Hudson River between the State dam and Fulton street in said city, have learned that the United States authorities are about to consummate the project of "The improvement of the channel of the Hudson River" at this point by creating a new channel about 150 feet in width opposite and in front of our respective properties; and

Whereas we find by the plans on file in the United States engineer's office in Albany, that this proposed improvement carries the easterly line of the said proposed new channel about 50 feet westward of the present pier and bulkhead line, as established by the harbor commissioners in the year 1890, and beyond or westward of which line we are now prohibited from extending our docks and bulkheads, both by the State authorities and the United States authorities, which practically deprives us of participating in the beneficial enjoyment which may be derived through this improvement of the channel and which we assume is intended for the general improvement of the commercial interests of the river;

We, therefore, most respectfully request that the pier and bulkhead line as established by the harbor commissioners in 1890 be so modified and amended to assume a course from a point in its present position at or near the foot of Rensselaer street, in said city of Troy, where said pier and bulkhead line runs about 5 feet distant in an easterly direction from the easterly line of the proposed new channel and running thence in a southerly direction on a course parallel with and about 5 feet distant easterly from said easterly line of said proposed new channel to a point in the vicinity of Fulton street, in said city of Troy, where the present pier and bulkhead line runs coincident with the easterly line of the proposed new channel, as shown on the maps in the United States engineer's office in Albany; and

Whereas your petitioners are anxious to begin proceedings at as early a date as possible before the commissioners of the land office of this State to acquire the legal right to proceed with the erection of docks and bulkheads and improvement of our water fronts, we humbly and most urgently request as prompt and speedy action in this matter as you can give it consistent with the numerous other duties requiring your official attention; and your petitioners will ever pray, etc.

DANIEL E. CONWAY,
Mayor of the City of Troy, N. Y.,
[AND OTHERS].

The honorable ELIHU ROOT,
Secretary of War of the United States.

F 38.

MODIFICATION OF HARBOR LINES ALONG HUDSON RIVER FROM PLEASANT VALLEY LANDING TO COYTESVILLE AND FROM COYTESVILLE TO BLOOMERS, NEW JERSEY.

RIPARIAN COMMISSION OF THE STATE OF NEW JERSEY,
Jersey City, N. J., April 5, 1900.

SIR: The riparian commission of the State of New Jersey hereby respectfully makes application for the extension of the exterior bulkhead and pier lines on the Hudson River, as follows:

BULKHEAD LINE.

Beginning at a point in the bulkhead line established by the riparian commission of the State of New Jersey December 11, 1875, and adopted by the Secretary of War October 18, 1890, said point being 260 feet easterly from the stone monument at Tillietudlum pier at Pleasant Valley Landing, and from thence northerly in a straight line to a point 255 feet easterly from the stone monument at John Pettigrew's stone quarries, marked "R. C. N. J. 1872;" thence northerly in a straight line to a point 450 feet easterly from the stone monument at Bloomers, marked "R. C. N. J. 1872," said last-mentioned point being in the exterior bulkhead line established by the riparian commissioners of New Jersey December 11, 1875, and adopted by the Secretary of War, October 18, 1890.

PIERHEAD LINE.

Beginning at a point in the pierhead line, as established by the riparian commissioners of the State of New Jersey, 1865, and adopted by the Secretary of War October 18, 1890, said point being distant 560 feet easterly from the stone monument at Tillietudlum pier at Pleasant Valley Landing, and from thence northerly in a straight line to a point distant 555 feet easterly from the stone monument at John Pettigrew's stone quarries, marked "R. C. N. J. 1872;" thence northerly in a straight line to a point 950 feet easterly from the stone monument at Bloomers, marked "R. C. N. J. 1872," said last-mentioned point being in the exterior pierhead line established by the riparian commissioners of New Jersey in 1865, and adopted by the Secretary of War October 18, 1890.

The lines for bulkhead and piers hereby presented for consideration and adoption, if approved, are shown in blue on the map¹ hereto annexed.

The commission respectfully calls the attention of the Secretary of War to the fact that these lines now presented for adoption are the original lines established by the riparian commissioners of the State of New Jersey, and out to which the grants of lands under water have been made by said commission, and to which improvements have been constructed.

That on February 17, 1883, Mr. P. S. Ross secured from the State of New Jersey a grant of land under water at Coytesville, shown on the annexed map, and improved the same out to the bulkhead line established by the State of New Jersey and defined in the grant to said Ross.

That on October 18, 1890, the lines between Pleasant Valley Landing and Bloomers Landing, shown in red on the accompanying map, were approved by the War Department as the lines for bulkheads and piers between said points.

The riparian commission respectfully refers to the fact that upon the application of said P. S. Ross that his property at Coytesville be

¹Not printed.

exempted from the operation of the pierhead and bulkhead lines established by the War Department in 1890, the Chief of Engineers, United States Army, under date of September 10, 1897, was directed to advise Mr. Ross that he might utilize his grant from the State of New Jersey to the lines laid down by the New Jersey riparian commission. The commission desires that the section not then considered by the War Department, extending from Pleasant Valley Landing to Coytesville and from Coytesville to Bloomers, be now considered and the lines extended in accordance with this petition.

Respectfully submitted.

THE RIPARIAN COMMISSION OF THE
STATE OF NEW JERSEY,

JOHN C. PAYNE,
Secretary and Engineer.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, June 30, 1900.

GENERAL: The New York Harbor Line Board has had under consideration the application to the Secretary of War by the riparian commission of New Jersey, dated April 5, 1900, for extension of pierhead lines on the Hudson River from Pleasant Valley Landing to Coytesville and from Coytesville to Bloomers, N. J., which was referred to the Board for consideration and report by your indorsement of April 18, 1900.

The Board has visited the locality since the receipt of the papers, and has given careful consideration to the subject of modifying the harbor lines established by the Secretary of War in 1890 between Pleasant Valley Landing and Bloomers, N. J.

At a public hearing given by the Board in this matter on May 14, 1900, no new facts were developed and no evidence was given that any riparian owner or prospective riparian owner proposes in the near future to improve the shore front between the points named. The Board is therefore of the opinion that the application for the pierhead line established by the State of New Jersey in 1875 should not be granted at this time. Since, however, Mr. P. Sanford Ross had, at the date of the Board's report on these lines, already partly availed himself of the right conveyed to him by the riparian commission of New Jersey in 1875, and has had his construction approved by the Secretary of War September 8, 1897, the Board, in justice to the riparian owners on this front who do not share in the rights enjoyed by Mr. Ross, recedes from its former position on this question, and now recommends that the bulkhead line established by the riparian commission of New Jersey from Pleasant Valley Landing to Bloomers, N. J., in 1875, be established by the Secretary of War as the future Government bulkhead line in lieu of the one established by him in 1890.

It is to be understood that the existing Government pierhead line of 1890 northward of Pleasant Valley Landing shall remain unchanged

to its point of intersection with the said bulkhead line of 1875, and that thence northward to Bloomers it shall be coincident with the said State bulkhead line of 1875, and that the two shall constitute for this distance the future pierhead and bulkhead lines adopted by the United States.

A tracing¹ accompanies this report showing the modified line as herein recommended.

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.

J. W. BARLOW,
Colonel, Corps of Engineers.

G. L. GILLESPIE,
Colonel, Corps of Engineers.

E. H. RUFFNER,
Major, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

* * * * *

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 9, 1900.

Respectfully returned to the Secretary of War.

The riparian commission of New Jersey requests a modification of the established harbor lines along the Hudson River from Pleasant Valley Landing to Coytesville, and from Coytesville to Bloomers, N. J.

The petition has been referred to the New York Harbor Line Board, which, after careful consideration, recommends a modification of the lines between Pleasant Valley Landing and Bloomers, as shown in red on the accompanying tracing.¹ The reasons upon which the conclusions of the Board are based are given in report of the 30th ultimo herewith.

I recommend that the modification suggested by the Board be approved, and that the Secretary place his approval on the tracing, which has been prepared for his signature.

A. MACKENZIE,
Acting Chief of Engineers.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of July 12, 1900, the approval being indicated on the map.

¹ Not printed.

F 39.

MODIFICATION OF HARBOR LINES ALONG HUDSON RIVER IN THE VICINITY OF GUTTENBERG, NEW JERSEY.

SIR: The undersigned, owners of property to be affected thereby, respectfully apply for a modification of the pier line on the Hudson River, partly in front of lands owned by them.

They direct your attention to the fact that they are conducting business as a railroad corporation on the Hudson River, at Weehawken, in the State of New Jersey. That they are the owners of a water front on the Hudson River there of about 6,800 feet in length. That the high rock—a continuation of the Palisades—runs parallel with, and a short distance westerly from, the Hudson River at that point. That the land so owned by your applicants is being developed for railroad purposes, and is a narrow strip of meadow land between the foot of the high rocks on the west and Hudson River on the east. That your applicants have expended, and are expending, many hundred thousands of dollars in constructing there a freight terminus for the freight business of your applicants.

That prior to 1897 application was made to the Secretary of War, by the riparian commissioners of the State of New Jersey, for an extension of the pierhead line from a point in Weehawken south of the Delaware and Hudson Canal Basin northerly to a point opposite Bulls Ferry. That the shore front for most of said distance was owned by your applicants. That they were not notified of such proceedings, and were not parties to them.

That on May 18, 1897, said pier line was fixed and adopted.

That, at a point near the northerly end of the shore front of your applicants, the said pierhead line as approved on May 18, 1897, bends toward the west and toward the shore, evidently with the object of reaching the pierhead line as previously established at Bulls Ferry. This defection of the pierhead line at the northerly end of the property of your applicants seriously injures their development of that portion of the property for their freight yard and business purposes.

The character of the upland adjoining the land under water at that northerly portion of the water front of your applicants is such as to make it practically impossible to encroach upon the upland for the purpose of increasing the pier length. That the space between the foot of the rocky bluff and the line of solid filling there is very narrow. The bluff of solid rock extends at that point farther out toward the river than at any point north or south of the same.

Your applicants ask for the extension of the pierhead line on that northerly portion of their property as shown on the map¹ hereto annexed, which is a copy of the map approved by the honorable Secretary of War in May, 1897. The extension asked for is shown by a red line on which are printed the words, "Proposed extension of pierhead line."

Your applicants respectfully call attention to the fact that the greatest extension asked for is about 150 feet; that at this point where the greatest extension is asked for there will remain an available width between the line asked for and the existing pierhead line on the New

¹ Not printed.

York side of the river of over 2,700 feet, while at a point about 4,000 feet south of the point in question and between it and New York Bay the available width of the river is only 2,650 feet between said pier-head lines.

Your applicants respectfully present that this extension can not in any way injuriously affect the Hudson River or the navigation of the same.

The extension asked for begins at a point fixed by the Secretary of War in 1897, about 3,200 feet south of Guttenberg and practically continues a line fixed by the Secretary of War in 1897 northward to a point 500 feet from the present bulkhead line at Guttenberg, and from that latter point northerly in a straight line to the present pierhead line at Bulls Ferry.

That this extension is absolutely necessary to enable your applicants to utilize their water front in the manner which their business requires. That the piers, confined as to length, by the line as at present existing, would be useless to your applicants for the purposes for which the said freight yard is required.

That, in the belief that the pierhead line in front of said property was the same width as that in front of the remainder of your applicants' property, work had been commenced and prosecuted to a considerable extent at the point in question before your applicants were aware of their error, and large amounts expended in accordance with such plans.

Your applicants request, therefore, that the pierhead line may be modified, as above stated, in accordance with and as shown on the blue print hereto annexed.

[SEAL.]

THE NEW YORK CENTRAL AND
HUDSON RIVER RAILROAD COMPANY,
By S. M. CALLAWAY, *President.*

Attest:

E. D. WORCESTER,
Secretary.

Approved.

W. J. WILGUS, *Chief Engineer.*

Hon. ELIHU ROOT,
Secretary of War.

* * * * *

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 20, 1901.

Respectfully returned to the Secretary of War.

Application is made by the New York Central and Hudson River Railroad Company for modification of the pierhead line established by the Secretary of War May 18, 1897, along Hudson River in the vicinity of Guttenberg, N. J.

The application has been considered by the New York Harbor Line Board, whose report of the 17th instant is herewith.

Concurreing in the views of the Board I recommend that the exist-

ing pierhead line in the locality mentioned be modified as described by the Board and shown by full blue lines on the accompanying map.¹ The map has been prepared for the signature of the Secretary.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on map mentioned were approved by the Secretary of War May 21, 1901, the approval being indicated on the map.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, May 17, 1901.

GENERAL: The New York Harbor Line Board has considered the petition of the New York Central and Hudson River Railroad Company for a modification of the pierhead line on the west side of the Hudson River in the vicinity of Guttenberg, N. J., referred to the Board by your indorsement of May 14, 1901, and has the honor to report that the Board sees no objection to the approval of the application.

It is therefore recommended that the existing pierhead line in this locality as approved by the Secretary of War May 18, 1897, be modified as follows:

Beginning at a point in the pierhead line approved by the Secretary of War May 18, 1897, at the point of intersection of a line bearing S. 52° 30' E. and passing through the tavern at the Shore road south of Guttenberg, 500 feet from the established bulkhead line, or 1,680 feet from said tavern; thence northerly in a straight line to a point in a line bearing S. 53° E. and passing through the southeast corner of the brewery at Guttenberg, 500 feet from the established bulkhead line, or 1,334 feet from the said brewery; thence in a straight line to the point of intersection of the pierhead line approved by the Secretary October 18, 1890, and the modified pierhead line approved by the Secretary of War May 18, 1897, being in a line bearing S. 55° 10' E. from Shady Side Hotel at Bull's Ferry 300 feet from the established bulkhead line, or 1,290 feet from said hotel.

Accompanying this report is a lithographic harbor-line map on which is shown in blue the modified pierhead line recommended for the approval of the Secretary of War.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
S. M. MANSFIELD,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

¹ Not printed.

F 40.

MODIFICATION OF HARBOR LINES IN NEWARK BAY, NEW JERSEY.

RIPARIAN COMMISSION OF THE STATE OF NEW JERSEY,
Jersey City, N. J., March 20, 1901.

DEAR SIR: I send you two petitions to the Secretary of War in the matter of the line on Newark Bay, one of which petitions applies to the restoration of the riparian commissioners' line, which I have marked on the map in pencil, and the other applies to a line outside that, on which I have marked "line suggested."

My idea in drawing these two petitions is that at first it seemed to me the better thing to do to ask the Secretary of War to restore the riparian commissioners' exterior line, in that it would have the prestige of having been established and adopted by the riparian commission. This is about its only merit, in my estimation.

I see no objection to the outer line marked "line suggested." You will see it is practically in continuation of the dike built by the Government. It runs practically along the edge of the 6-foot curve; it leaves a considerable width to the bay and of the best water, and would confine the channel and deepen the water, in my estimation. If I were in your position I would ask for this line.

I shall be glad to talk the matter over with you, or, whichever line you desire, if you will be kind enough to return me the map and the application, I will draw the line on the map in blue, as it is so referred to in the application, and will back the application and return the same to you for presentation to the Secretary of War.

I do not think there will be anything in the application of the Central Railroad of New Jersey that will conflict with this, and if it is going to embarrass your application by waiting for the Central, you could go ahead and present yours at once.

Kindly let me know what you decide to do.

Yours, very truly,

J. C. PAYNE,
Secretary and Engineer.

Mr. J. W. WHELAN,
Elizabeth, N. J.

* * * * *

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
 U. S. ARMY,
May 9, 1901.

Respectfully submitted to the Secretary of War.

These papers cover petitions for a modification of the established harbor lines on the west side of Newark Bay.

The subject has been under consideration by the New York Harbor Line Board, to whose report of the 30th ultimo, herewith, attention is respectfully invited.

For reasons stated in the report the Board recommends that the bulkhead line as now established be not changed, but that the pierhead line from the southern side of the fill of the Waverly and New York

Railroad Company southward to the bridge of the Central Railroad of New Jersey be located parallel to the bulkhead line and 500 feet exterior thereto, this being an advancement of the established pierhead line. The full blue line on the accompanying lithograph¹ shows the new pierhead line adopted by the Board.

I concur in the views and recommendations of the Board. The map has been prepared for the signature of the Secretary.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War May 13, 1901, the approval being indicated on the map.

REPORT OF NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, April 30, 1901.

GENERAL: The New York Harbor Line Board has the two petitions signed by Hon. John Kean, United States Senator, referred to the Board by your indorsement of March 25, 1901, applying for an extension of the harbor lines on the west side of Newark Bay, and has the honor to submit the following report thereon:

A public hearing in this matter was given by the Board on April 20, 1901, at which there was a large attendance, composed chiefly of representatives of interests connected with land improvements on the west shore from the mouth of the Passaic River, New Jersey, south to Elizabethport. The stenographic report¹ of this hearing is inclosed herewith, marked "A."

While the hearing was in progress, the general counsel of the Central Railroad of New Jersey presented a written application on the part of the railroad company, conformable to the application of Senator Kean. The secretary and engineer of the riparian commission of New Jersey was also present to explain the lines previously established by the commission on the west shore. There were present no representatives from any of the towns in New Jersey adjacent to Newark Bay.

The application in effect is for authority to extend the bulkhead line on the west shore from the south end of the dike southward to Elizabethport for an average distance of 2,500 feet into the bay, under the plea that the exterior pierhead line as now established is on an average of 2,500 feet from the curve of 6 feet depth of water, and that the intervening bed of the bay is a mud flat over which the average depth at low water is not more than 2 feet; and further, that in order to make the present pierhead and bulkhead lines available, it will be necessary in the case of each improvement projected to dredge the channel through this area of mud flat. It was also argued at the hearing that the advancement of the bulkhead line would contract the chan-

¹ Not printed.

nel and give a more uniform direction to the currents, resulting in the improvement and better maintenance of the main channel through the bay.

Newark Bay is a fine inner bay, 6 miles long, measured north and south, and $1\frac{1}{2}$ miles wide, with a navigable channel toward the east shore of 2,000 feet width, and 8 to 10 feet depth at low water. A dike was built by the United States during 1880-1887 on the west side of the entrance to the Passaic River for the purpose of training the waters of that river in a way to cut out the bar and maintain a navigable depth through it of 10 feet at low stage. It has been proposed to extend this dike farther to the southward to enlarge the area of its effectiveness, but appropriations therefor have not been made. This dike is 2,500 feet distant from the west shore, and subsequent to its construction authority was given to the Waverly and New York Railroad Company to fill in the water area behind it within the limits owned by their company to facilitate the construction of the bridge at this point.

In 1890, when the Harbor Line Board recommended harbor lines on this bay for the approval of the Secretary of War, it was deemed best to preserve and protect the waters of the bay by following the Government dike from its north abutment to the southern end of the railroad fill and thence to the shore along its southern side. Since 1890 no change has been made in the lines. An application is now made that the west shore lines be moved out, not that the navigation of the bay and its tributaries are suffering on account of deficient depths, but that riparian owners on the west shore may be enabled to improve their own lands and fill in submerged lands for industrial purposes. The project of reclaiming the swamp lands is a natural and worthy one, which will eventually add greatly to the prosperity and wealth of the State of New Jersey and its citizens, but the Board thinks that it can be attained equally well without filling up and injuring Newark Bay, waters which should be carefully preserved against unnecessary encroachment.

The Board has given careful consideration to the petitions and to the arguments made at the public hearing, and while disposed to make the largest concessions to urgent demands of commerce, is constrained to report that the applications are vastly in excess of public needs.

The area proposed to be filled in measures 1,000 acres approximately, which means, in general terms, that about one-third of the entire bay will be filled in if the petitions are granted.

If a like authority be granted hereafter to riparian holders on the east side, and it is reasonable to anticipate that they will apply for such authority, Newark Bay will in the end be reduced to one-third of its original proportions, and converted into a kill like its connections with the upper and lower bay of New York Harbor. The beauty and advantages of the bay and the picturesqueness of the bounding shores will be destroyed, and the navigable capacity of Newark Bay and the Passaic and Hackensack rivers will be largely diminished.

After mature deliberation the Board recommends that the bulkhead line on the west shore, as now established, be not changed, and that the pierhead line from the southern side of the fill of the Waverly and New York Railroad Company southward to the bridge of the Central Railroad of New Jersey be located parallel to the bulkhead line and 500 feet exterior thereto, this latter line being advanced beyond the established pierhead line in order to give adequate berth to vessels

which may wish to serve the factories and shops proposed to be built upon the reclaimed lands on the west shore.

South of the Central Railroad bridge there will be no change in the bulkhead line. The pierhead line will begin at a point on the bridge 500 feet from the north bulkhead line, and run thence south to the northeast corner of the dock next south of the railroad, and thence connecting with the established pierhead line.

The pier and bulkhead lines as now recommended for the west shore are delineated upon the accompanying lithograph.¹ No more detailed description of these lines seems necessary.

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.

J. W. BARLOW,
Colonel, Corps of Engineers.

G. L. GILLESPIE,
Colonel, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

F 41.

MODIFICATION OF HARBOR LINES IN ARTHUR KILL, AT MOUTH OF
RAHWAY RIVER, NEW JERSEY.

NEW YORK, *April 11, 1901.*

SIR: On behalf of Messrs. Milliken Brothers and the American-McKenna Process Company, we respectfully request that the United States Government bulkhead line at the junction of Staten Island Sound (otherwise known as Arthur Kill) and the Rahway River, at Tremley Point, New Jersey, be made to coincide with the bulkhead line established by the riparian commission of the State of New Jersey, as shown on the inclosed certified maps.¹ The certificate indorsed on the map states that the line established by the riparian commission of the State of New Jersey coincides with the bulkhead line adopted by the United States Government March 4, 1890, but upon inquiry at the office of the Harbor Line Board in this city, and a comparison of maps, we are advised that this is an error, and that the lines established by the State of New Jersey and the United States are not coincident.

Messrs. Milliken Brothers and the American-McKenna Process Company are the owners of all of the uplands shown on the inclosed map. The former are civil engineers and contractors in iron and steel construction, maintaining extensive machine and bridge shops in Brooklyn. They have recently purchased at Tremley Point, New Jersey, a tract of about 20 acres, having a water front of nearly 1,000 feet on Staten Island Sound and of about 600 feet on the Rahway River, with the intention of removing their bridge works from Brooklyn to this point. They have obtained a grant from the State of New Jersey out to the bulkhead line shown on this map, opposite to a portion of their prop-

¹ Not printed.

erty, and a resolution has been passed by the riparian commission fixing the terms of a grant to them of the land under water to the bulkhead line opposite the remainder of their land. The American-McKenna Process Company is engaged in the business of rolling steel rails. The company owns a tract of about 30 acres at Tremley Point, having a water front of over 1,300 feet on the Staten Island Sound and over 1,000 feet on the Rahway River, and this company has a grant of land under water from the State of New Jersey from the upland to the bulkhead line shown on the inclosed map, for the entire length of its water front both on the sound and the river. The company is about to build docks, slips, and terminal structures, and to erect on this property furnaces and a large manufactory for rolling steel rails, and it has already contracted for the work of piling, filling, etc.

The location of the Government line is therefore of serious moment to our clients, and the discovery that the Government line and State line are not coincident necessarily prevents them from proceeding with the work in accordance with the plans, which were designed upon the belief that the bulkhead line fixed by the riparian commission of New Jersey and the United States Government line were identical. A further reason for requesting a modification of the line as adopted by the Government in 1890 is the fact that this line is a curved line, whereas it is most desirable for practical use in connection with the improvements about to be erected at this point that the line should be as nearly as practicable a right line.

Inasmuch as the plans for the manufactories, docks, etc., at this point have been prepared with relation to the bulkhead line as certified to on the inclosed map, and to utilize the grants from the State of New Jersey of land under water to this line, and the progress of the work projected must be suspended until after the decision of this application, we would respectfully request as early a decision as can be reached with proper consideration of the subject. Should it be found that any practical objection exists in making the Government line coincide at all points with the State line, we respectfully request that the Government line be made coincident with the State line as nearly as possible.

Very respectfully, your obedient servants,

SHILAND & HONEYMAN.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, April 30, 1901.

GENERAL: The New York Harbor Line Board has given consideration to the application of Messrs. Shiland and Honeyman in behalf of Milliken Brothers and the American-McKenna Process Company, dated New York, April 11, 1901, for modification of the established pier and bulk head lines in Arthur Kill, at the mouth of the Rahway River, New Jersey, and has the honor to submit the following report:

The Board recommends that the present pier and bulk head lines in

the locality in question be modified as shown on the accompanying tracing.¹ The line herein recommended is shown in red. The modifications from a point marked "A" on the accompanying tracing to the mouth of the Rahway River show the changes from the present existing pierhead and bulkhead line in this locality; from that point a new line is recommended running northwesterly up the Rahway River for a distance of about 1,686 feet.

The following is a description of the new lines herein recommended for approval:

Beginning at a point on the south rail of the Sound Shore Railroad 203 feet south of the north end of the trestle crossing Rahway River, approximately 310 feet north from center of draw; thence running east and west. West from said point of beginning in a straight line bearing N. 46° 15' W. 1,112 feet; east from said point of beginning in a straight line bearing S. 46° 15' E. 574 feet; thence on the arc of a circle of 300 feet radius 485 feet; thence northerly in straight lines the following courses and distances:

N. 41° 10' E. 766 feet,

N. 29° 12' E. 477 feet,

N. 16° E. 860 feet,

N. 2° 10' E. 211 feet,

to the angle of the bulkhead opposite the south end of Chelsea Island, as at present built; thence in a straight line to a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, marked "A," said point being described on the approved map on file as 1,670 feet west of station XXII and at right angles to a line connecting stations XXII and XXIII.

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.

J. W. BARLOW,
Colonel, Corps of Engineers.

G. L. GILLESPIE,
Colonel, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 6, 1901.

Respectfully returned to the Secretary of War.

The New York Harbor Line Board having had under consideration an application for the modification of the established pierhead and bulkhead line in Arthur Kill, at the mouth of Rahway River, New Jersey, submits the within report recommending that the line be modified as shown in red on the accompanying tracing. The recommendation of the Board includes an extension of the line along the north shore of the Rahway River at its mouth.

I recommend that the modification be approved and that the Secretary of War place his approval on this report and on the tracing which has been prepared for his signature.

A. MACKENZIE,
Acting Chief of Engineers.

¹ Not printed.

[Second indorsement.]

WAR DEPARTMENT,
May 8, 1901

Approved as recommended by the Chief of Engineers.

E. ROOT,
Secretary of War.

F 42.

MODIFICATION OF HARBOR LINES IN SHREWSBURY RIVER AT
SEABRIGHT, NEW JERSEY.AMERICAN BICYCLE COMPANY,
SECRETARY'S OFFICE,
LEGAL DEPARTMENT,
New York, June 5, 1900.

DEAR SIR: I beg to make application herewith for alteration of a portion of the riparian lines of the South Shrewsbury River at Seabright, indicated on the accompanying map.¹

The alteration proposed applies only to the east side of the river, and covers a distance of about 900 feet. I represent all of the riparian owners of the portion affected, and have also been requested to act by the steamboat company, which is an evidence of the fact that the proposed change will benefit navigation on the river.

The property owners desire to extend the line of solid filling nearer to the present line of the channel, to bulkhead the new line, and pump from the channel for the purpose of filling. It is believed that the reclamation of what is now a flat will be a decided benefit from a sanitary point of view for the whole neighborhood, as at certain tides this shoal is offensive and a menace to the health of the community.

I inclose herewith a letter from Hon. Cornelius N. Bliss,¹ given at my request, and which I regret I can not present personally.

I trust that the application may have the consideration, on its merits, of the Board having jurisdiction, and shall be glad to furnish all data, information, or evidence bearing upon the change proposed and its probable effect.

Respectfully, yours,

PAUL WALTON.

Hon. ELIHU ROOT,
Secretary of War.

* * * * *

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 9, 1900.

Respectfully returned to the Secretary of War.

Mr. Paul Walton applies, on behalf of riparian owners, for a modification of harbor lines in Shrewsbury River, at Seabright, N. J.

The subject has been considered by the New York Harbor Line Board, whose report of the 5th instant is herewith.

A public hearing has been afforded interested parties, and the Board

¹ Not printed.

presents for approval coincident bulkhead and pierhead lines for both sides of the river as shown by full red lines on the accompanying tracing.¹

Approval of the lines is recommended, and the map has been prepared for the signature of the Secretary.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT,
October 10, 1900.

Approved as recommended by the Chief of Engineers.

G. D. MEIKLEJOHN,
Acting Secretary of War.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, October 5, 1900.

GENERAL: The New York Harbor Line Board has had under consideration the application to the Secretary of War by Mr. Paul Walton, dated New York, June 5, 1900, on behalf of riparian owners, for modification of existing harbor lines on the South Shrewsbury River at Seabright, N. J., these papers having been referred to the Board for consideration and report by your indorsement of June 13, 1900.

A public hearing in this matter was held at Seabright, N. J., on July 2, 1900, which was publicly advertised, at which the mayor and representatives of land and river interests were present. After the hearing the Board made a careful inspection of the water front at Seabright, from the turnpike bridge to near Sedge Island, in company with the petitioner and others; and subsequently a survey of the city front was made under the direction of the district officer to determine the accuracy of the dimensions and location of the piers as represented upon existing maps.

The Board gave the matter careful attention, and after drawing preliminary lines submitted them, unofficially, to the riparian commission of New Jersey, inviting an expression of their opinion upon them. The commission have since reported their views in a letter¹ of September 21, 1900, copy of which is herewith inclosed.

The commerce of the Shrewsbury River is carried by comparatively small steamboats, drawing about 5 feet, which it is reasonable to suppose will continue to be the vehicle of transportation of this river for a long period of time. These boats do not need to be berthed at Seabright at right angles to the stream and therefore no piers are required; the usual dock construction, which affords a convenient landing, will suffice for their service.

To meet the conditions as they exist at Seabright, the Board submits for the approval of the Secretary of War a coincident pier and bulkhead line from the bridge at Rumson road south to W. R. Riker's dock, which fully complies with the recommendation of the riparian commission of New Jersey, and which, if approved, will, in the opin-

¹ Not printed.

ion of the Board, preserve and protect the navigable waters of the Shrewsbury River within the intent of section 11 of the river and harbor act of March 3, 1889.

The Board has also in this connection considered the west bank, and respectfully recommends for approval a combined pierhead and bulkhead line there, extending from the turnpike bridge at Rumson road south to proposed Dike P, joining Marsh Island with the mainland near Jumping Point. This line conforms practically to the bulkhead line of the riparian commission, and partially established by the Secretary of War July 5, 1894, as a pierhead and bulkhead line, differing only from the latter in being made up of straight lines rather than a curved line, which can not be readily laid out in practice.

The recommended combined pier and bulkhead lines on the east and west banks, which are delineated upon an accompanying tracing, are more particularly described as follows:

DESCRIPTION OF THE PIER AND BULKHEAD LINE FOR BOTH SHORES OF THE SHREWSBURY RIVER AT SEABRIGHT, N. J.

For the easterly shore.—Beginning at a point in the southerly side of the turnpike bridge 51.5 feet west of the southwest corner of the east abutment; thence southerly in a straight line to a point in the westerly prolongation of a line 78 feet north of and parallel to the northerly side of Church street, 558 feet from the west side of Ocean avenue; thence southerly in a straight line to a point in the western prolongation of a line 20.5 feet south of the northerly side of Church street and 584 feet from the west side of Ocean avenue; thence southerly in a straight line to a point in the westerly prolongation of the south side of New street 580 feet from the west side of Ocean avenue; thence southerly in a straight line to a point in the westerly prolongation of the south side of Center street 520 feet from the intersection of the west side of Ocean avenue prolonged southerly; thence southerly in a straight line to a point in a line 410 feet south from the south side of Center street and at right angles to the westerly side of Ocean avenue prolonged southerly and 327 feet west therefrom; thence southerly in a straight line to a point in a line 655 feet south from the south side of Center street and at right angles to west side of Ocean avenue prolonged southerly and 292 feet, more or less, west therefrom, this point being in the line for solid filling established by the riparian commission of New Jersey and approved as a pierhead and bulkhead line by the Secretary of War February 5, 1894; thence southerly in a straight line along this approved line for a distance of 620 feet parallel to the center line of the original track of the New Jersey Southern Railroad and 300 feet west therefrom.

For the westerly shore.—Beginning at a point in the southerly side of the turnpike bridge 420 feet westerly of the intersection of the east pierhead and bulkhead line with the south side of the bridge; thence southerly in a straight line at an angle of $94^{\circ} 30'$ with the side of the bridge a distance of 780 feet; thence southerly in a straight line a distance of 370 feet parallel to the pierhead and bulkhead line on the easterly shore and 314 feet therefrom; thence southerly in a straight line a distance of 395 feet, more or less, at an angle of $169^{\circ} 27'$ with the aforesaid described line until it meets the line of Dike P proposed to be built by the United States.

HENRY M. ROBERT,
Colonel, Corps of Engineers.

J. W. BARLOW,
Colonel, Corps of Engineers.

G. L. GILLESPIE,
Colonel, Corps of Engineers.

E. H. RUFFNER,
Major, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

APPENDIX G.

IMPROVEMENT OF NEW YORK HARBOR, OF BAY RIDGE, RED HOOK,
AND BUTTERMILK CHANNELS, AND GOWANUS CREEK CHANNEL,
NEW YORK.

REPORT OF MAJ. W. L. MARSHALL, CORPS OF ENGINEERS, OFFICER
IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH
OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|--|
| 1. New York Harbor, New York. | 4. Enlargement of Governors Island, New York Harbor. |
| 2. Bay Ridge, Red Hook, and Buttermilk channels, New York Harbor. | 5. Removing sunken vessels or craft obstructing or endangering navigation. |
| 3. Gowanus Creek channel, New York. | |

EXAMINATION AND SURVEY.

6. Buttermilk channel, New York Harbor.

HARBOR LINES.

7. New York Harbor at College Point.
-

UNITED STATES ENGINEER OFFICE,
New York, N. Y., July 15, 1901.

GENERAL: I have the honor to submit herewith annual reports upon works of river and harbor improvement in my charge for the fiscal year ending June 30, 1901.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

G 1.

IMPROVEMENT OF NEW YORK HARBOR, NEW YORK.

New York Harbor is the general designation of the water front of and approaches to the city of New York, comprising the Upper and Lower bays and parts of the Hudson, East, and Harlem rivers.

New York Harbor has two entrances, one from Long Island Sound

by East River and Hell Gate, used by vessels trading eastward between New York, the Eastern States, and British American Provinces; the other, the main entrance from the sea, by Sandy Hook, through the Narrows, used by trans-Atlantic and southern traffic. The title "Improvement of New York Harbor" has been applied to improvement of the channel of the main entrance from the sea.

From the Battery, at the lower end of New York City, out through the Narrows to the Lower Bay, a total distance of about 9 miles, there is a natural channel, fairly broad and unobstructed, with available depths of 45 feet or more at mean low tide. The Lower Bay is separated from deep water of the ocean by a bar from 2 to 5 miles across, which, except for the channels crossing it, extends all the way from Sandy Hook to the west end of Coney Island, a distance of 7 miles. On the west side of this bar the Main Ship channel extends southward from the Narrows to Sandy Hook, with natural depth of 23.3 feet, since deepened to 30 feet depth, mean low water.

Five distinct natural channels, separated by sand shoals, cross this bar, in order as follows, from the north or Coney Island shore:

(1) The Coney Island channel, straight, narrow, with a general depth of 20 feet, except at the west end, where the available depth is but 10 feet. South of this channel lies a shoal known as East Bank, with least depth of 6 feet.

(2) The Fourteen-foot channel, a curving channel with considerable depths in the west part, but with only 15 feet depth at the eastern end. To the south lies a shoal with 5½ feet least depth.

(3) The East channel, a broad, nearly straight, channel, of 30 feet depth or more in the western part, separated from deep water on the east by a bar having only 19 feet depth. South of this channel lies Romer shoal, with 3 feet least depth.

(4) The Swash channel, with 22 feet depth in a narrow channel. To the south lies a shoal called Flynn's Knoll, with least depth of 11 feet.

(5) The Bayside channel, formerly called Main channel, a broad channel passing close to the north shore of Sandy Hook, with natural depth of 28 feet.

The southern part of the Main Ship channel, with the Swash and Bayside channels, form nearly an equilateral triangle, the two last named intersecting in a deep hole of considerable area rather more than midway across the bar. Outside this deep hole the bar was about 20 feet deep and was crossed by two channels, the north, called Gedney channel, about 1½ miles long to deep water, and the south, called South channel, somewhat longer, extending southeast nearly in continuation of the Swash channel. Gedney and South channels both had natural depths of 24 feet.

Thus the natural channels afforded an available low-water depth from the ocean to the lower wharves of New York City of 23.3 feet, the distance from the outer side of the outer bar being 21 miles.

PROJECT FOR IMPROVEMENT.

The project, as adopted in 1884 and subsequently extended, consisted in making and maintaining a channel 1,000 feet wide and 30 feet deep at mean low water from New York Harbor to deep water in the Atlantic, by way of the Main Ship, Bayside, and Gedney channels, at an estimated cost of \$1,490,000. Work was begun September 26, 1885, and the project was completed October 10, 1891. Appropriations since that time have been applied to maintaining the channel by increasing its width and by removing shoals.

Under special projects between 1863 and 1894 small allotments from various appropriations have been from time to time expended in pro-

teeting the north shore of Sandy Hook by building jetties from high-water mark out to below low water and by building riprap sea walls alongshore just below high-water line; and other allotments have been applied to excavating in other parts of New York Harbor.

Under the terms of the river and harbor act of March 3, 1899, a new project was adopted for connecting deep water in the lower bay with the ocean, by channel 2,000 feet wide and 40 feet deep at mean low water, crossing the bar by way of Ambrose channel (formerly called the East channel) at a limit of cost of \$4,000,000.

Further detailed descriptions of the harbor and improvements are printed in the Annual Reports of the Chief of Engineers for 1885, page 773, and for 1897, page 1031.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

At the beginning of the year the U. S. dredging steamer *Gedney* was working on shoals in the Main Ship channel. From July 5 to September 22 she was transferred to a shoal on the northwest side of Bayside channel, east of the Swash channel range, then returning to Main Ship channel and continuing excavation there throughout the year, except for the period January 17 to April 3, when she was laid up for winter and for extensive repairs. During the year the total amount excavated was 219,880 cubic yards, of which 119,594 cubic yards of sand were taken from Bayside channel, 26,283 cubic yards of mud from the east side of Main Ship channel, south of buoy C 6, and 74,003 cubic yards of mud, with a small proportion of sand, from the west side of Main Ship channel, from buoy C 3 to 600 feet north of C 5.

The working time and lost time during the year were as follows:

	Days.
Actually at work.....	145
Work prevented by weather, fog, ice, storms, etc.....	73
Time occupied in repairs and coaling.....	19
Other causes.....	4
Laid up during the winter.....	76
Sundays and holidays.....	48
Total.....	365

The principal repairs were made during the time when the dredge was laid up for the winter.

The actual cost of operating expenses per cubic yard of material dredged, including repairs and supplies, is estimated at 12.4 cents during the past year, of which 6.8 cents was due to wages, 2.7 cents to fuel and water, and 2.9 cents to repairs and supplies.

From the appropriation for maintenance of channels, the following additional work was authorized by the Chief of Engineers, and was done under informal agreement after inviting offers for excavation.

At Coney Island Channel part of an old shoal, known as the "Lewis," was removed and the channel straightened, making it 500 to 560 feet wide and 14 feet deep at mean low water. The work was done by the R. G. Packard Company, August 21 to November 17, 1900, removing 38,460 cubic yards, at price of 24 cents per yard.

At Fort Hamilton pier the channel of approach was deepened, making it 14 feet deep at mean low water and 100 feet wide, with extensions along each side of the pierhead. The work was done by the R. G. Packard Company in September, removing 10,978 cubic yards at price of 22 cents per yard.

At Fort Hancock pier the channel at the north and south landings was deepened to 13 and 15 feet at mean low water, with widths of 60 and 80 feet, respectively. The work was done by the W. H. Beard Dredging Company in October, 5,266 cubic yards of sand being removed at price of $29\frac{3}{4}$ cents per cubic yard.

Under the project for making Ambrose channel 2,000 feet wide and 40 feet deep at mean low water, a contract was entered into May 12, 1899, approved by the Chief of Engineers May 24, 1899, for excavating the channel and removing about 42,500,000 cubic yards of material, at 9 cents per yard, scow measure. The specifications required that excavation should begin within twelve months from the date of approval of the contract, and should continue during eight working months of each year, at an average monthly rate of not less than 400,000 cubic yards for the first working year, and not less than 1,200,000 cubic yards for each succeeding year.

Delays in construction of plant, which the contractor claims were unavoidable, prevented the beginning of the work at the time specified. The first excavation was made January 22, 1901, but continuous work was not begun until May 6, with the first dredge, and June 10, with the second dredge. Up to the close of the fiscal year 423,209 cubic yards of sand have been removed from the outer side of the bar at the outer end of the channel, making depths of 40 feet or over where the previous depths had been from 23 to 40 feet.

Various delays have occurred in the work, chiefly due to unfamiliarity of the contractor's men with the machinery and the method of handling it. This is gradually improving. Each dredge is provided with a single suction pipe terminating in a large nozzle, and the method of working is to sink this nozzle down to depths somewhat below the required depth and make large pockets or craters as nearly continuous as may be. This method has been tried satisfactorily in Liverpool, the bottom gradually leveling off. So far it is in the nature of an experiment here, with indications that a suction drag or other means of leveling the bottom will be needed ultimately. With experience in handling the dredges the average daily output is gradually increasing. The largest day's work yet done by one dredge is removal of 16,469 cubic yards.

Surveys have been made of the outer part of Ambrose channel and of Bayside and Main Ship channels.

PRESENT CONDITION OF IMPROVEMENT.

The improved channel from deep water below the Narrows to the sea by way of Sandy Hook has a depth of 30 feet at mean low water and general width of 1,000 feet or more throughout its length. At Northwest shoal the channel has been made 2,000 feet wide.

The available depth across the bar at Ambrose (East) channel is 16 feet, the excavation recently begun not having reached the shoal part of the bar.

PROPOSED OPERATIONS.

Under the completed project of 1884 the available funds and future appropriations will be applied to maintaining the channel depths and to increasing the width at points where shoaling has occurred.

Under the project of 1899 excavating Ambrose channel will be continued.

This work is in the collection district of New York. Nearest light-houses, Sandy Hook and Highland lights. The nearest forts are Fort Hancock, Sandy Hook, New Jersey; and Forts Hamilton and Wadsworth, at the Narrows, New York Harbor.

Following is explicit information as to estimate of funds required for the fiscal year ending June 30, 1903, for dredging Ambrose channel under the continuing contract authorized by the river and harbor act of March 3, 1899:

The river and harbor act of 1899 appropriated \$1,000,000 for improving New York Harbor "by a deep channel 2,000 feet wide and 40 feet deep from the Narrows, by the so-called East channel" (since named Ambrose channel) "across Sandy Hook bar to the open sea;" and also authorized the entering into a contract or contracts for the completion of the project at a cost "not to exceed in the aggregate \$3,000,000, exclusive of the amount herein and heretofore appropriated." The amounts appropriated for this work aggregate \$1,130,000.

Under the terms of the contract the contractor is required to dredge, by June 30, 1903, a minimum amount of 23,840,000 cubic yards, which, at a cost of 9 cents per cubic yard, amounts to \$2,145,600. It is not probable that he will be able to excavate this amount by the date named. It is estimated that 16,000,000 cubic yards, more or less, amounting to about \$1,430,000, will be the limit of liability to be incurred under this contract up to June 30, 1903.

For this reason \$300,000 is estimated as the amount required, in addition to available funds, to meet obligations up to June 30, 1903, under continuing contract for improving Ambrose channel.

Appropriations for improving New York Harbor have been made as follows:

Application.	Date.	Amount.
For Gedney channel, dredging via Sandy Hook	July 5, 1884	\$200,000.00
For New York Harbor	Aug. 5, 1886	750,000.00
Do	Aug. 11, 1888	380,000.00
Do	Sept. 19, 1890	160,000.00
Do	July 13, 1892	170,000.00
Do	Aug. 18, 1894	75,000.00
Do	June 3, 1896	60,000.00
Do	Mar. 3, 1899	100,000.00
		1,895,000.00
Received from other sources		28,024.52
Total		1,923,024.52
For East (Ambrose) channel, dredging	Mar. 3, 1899	1,000,000.00
Do	Mar. 3, 1901	130,000.00

Money statements.

GENERAL IMPROVEMENT.

July 1, 1900, balance unexpended	\$62,481.25
June 30, 1901, amount expended during fiscal year	46,652.35
June 1, 1901, balance unexpended	15,828.90
July 1, 1901, outstanding liabilities	1,980.61
July 1, 1901, balance available	13,848.29
{ Amount that can be profitably expended in fiscal year ending June 30,	
{ 1903, in addition to the balance unexpended July 1, 1901	100,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

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AMBROSE CHANNEL.

July 1, 1900, balance unexpended	\$999,350.04	
Amount appropriated by sundry civil act approved March 3, 1901	130,000.00	
		\$1,129,350.04
June 30, 1901, amount expended during fiscal year	32,719.25	
July 30, 1901, amount withdrawn, expenses office Chief of Engineers	800.00	
		33,519.25
July 1, 1901, balance unexpended		1,095,830.79
July 1, 1901, outstanding liabilities		39,277.81
		1,056,552.98
July 1, 1901, balance available		3,786,911.19
July 1, 1901, amount covered by uncompleted contracts		2,870,000.00
{ Amount (estimated) required for completion of existing project		2,870,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901		300,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

With Andrew Onderdonk, of New York City, N. Y., for excavating in East (Ambrose) channel, New York Harbor, and removing about 42,500,000 cubic yards of material, at a rate of 9 cents per cubic yard; date of contract, May 12, 1899; approved by the Chief of Engineers May 24, 1899; date for beginning work, twelve months from date of approval of contract; date of expiration, indefinite, depending on appropriations by Congress. Work in progress.

COMMERCIAL STATISTICS.

The following statement concerning foreign commerce of the port of New York is compiled from the annual report of the Chamber of Commerce of the State of New York for the year 1900-1901. It comprises only imports from and exports to foreign countries, and does not include the domestic, coastwise, and local traffic. Vessels trading with domestic ports are not required to take out clearance papers, and no attempt is made to collect statistics of their carrying trade.

The leading articles of imports into the United States at the port of New York for the year ending June 30, 1900, were sugar, molasses, coffee and tea, wool, cloths and dress goods, leather and leather goods, tin, rubber, tobacco, with other miscellaneous imports, aggregating about 3,900,000 tons, valued at \$562,002,535.

The value of such imports for all other ports of the United States for the same period was \$367,768,135.

The leading articles of export were cotton, breadstuffs and other provisions, oils, tobacco, metals, and manufactures, which with miscellaneous items aggregated about 6,900,000 tons, valued at \$615,460,500.

The value of such exports for all other ports of the United States for the same year was \$898,525,339.

Statement of the number and tonnage of all vessels belonging to the port of New York, June 30, 1900.

Class.	Number.	Tonnage.
Sailing vessels	1,499	303,207
Steam vessels	1,205	556,276
Canal boats	235	29,627
Barges	961	223,879
Total	3,900	1,112,989

From the records of the New York and New Jersey pilot commissioners the following data concerning deep-draft vessels crossing Sandy Hook bar have been compiled for the calendar year 1900:

Draft.	Leaving.		Arriving.	
	Number of vessels.	Number of trips.	Number of vessels.	Number of trips.
32 feet or over.....	8	21	.....	.....
31 feet and under 32 feet.....	13	30	.....	.....
30 feet and under 31 feet.....	19	53	.....	.....
29 feet and under 30 feet.....	26	87	2	3
28 feet and under 29 feet.....	17	152	4	9
27 feet and under 28 feet.....	72	208	6	21

Maximum draft of vessels leaving the harbor, 32 feet 9 inches. Maximum draft of vessels entering the harbor, 29 feet.

Total number of vessels 27 feet draft or over, 109.

Prior to the improvement of Gedney channel vessels drawing 27 feet could cross the bar only at extreme high tide.

G 2.

IMPROVEMENT OF GOWANUS BAY CHANNEL, BAY RIDGE, RED HOOK, AND BUTTERMILK CHANNELS, NEW YORK HARBOR.

The main channel from The Narrows to the East River, New York Harbor, passes to the west and northwest of Governors Island. It has natural depths of 35 feet or over and generally an ample width. There is an eastern channel which skirts the Brooklyn water front, extending northwardly from Bay Ridge, crossing Gowanus Bay, rounding Red Hook, and thence by way of Buttermilk channel, connecting with the East River. The lower part of this channel from Bay Ridge to Erie Basin had natural depths of from 7 to 12 feet. Opposite Gowanus Bay it was separated from the main channel of the harbor by a large shoal of about 9 feet depth; the upper part had a depth of 26 feet in a channel 300 feet wide or more, but crooked, and on account of the rapid current and the large amount of traffic in and near its junction with the East River it was formerly regarded as one of the most difficult places to navigate in New York waters. The line of docks along the water front of this east channel, and especially in the upper part, from the Brooklyn Bridge to Red Hook, is one of the most important in New York Harbor.

PROJECTS FOR IMPROVEMENT.

Prior to 1896 this improvement was carried on under two separate titles: Improvement of Buttermilk channel, New York Harbor, which included the removal of Buttermilk and Red Hook shoals, and improvement of Gowanus Bay, New York Harbor, which included Bay Ridge and Red Hook channels and the triangular area between them, and also Gowanus Creek channel.

In 1880 a project was adopted, which was subsequently extended to provide for the entire removal of Buttermilk shoal, in the north part of Buttermilk channel, to 26 feet depth. This work was completed July 3, 1891, 1,269,484 cubic yards of material having been removed at a total cost of \$321,000.

In 1890 a project was adopted for removing to 26 feet depth Red Hook shoal, in Buttermilk channel, between Red Hook Point and Governors Island. Up to July 1, 1896, nearly one-third of this shoal had been removed.

Under the river and harbor act of 1880 a project for improving Gowanus Bay channels was adopted, providing for a depth of 21 feet at mean low water, afterwards increased to 26 feet depth. Under this project as modified up to July 1, 1896, Red Hook channel had been made 200 feet wide and 26 feet deep, an additional 150 feet of width being made 21 feet deep; Gowanus Creek had been made 21 feet deep between the harbor lines; Gowanus Canal had been made 12 feet deep up to Hamilton Avenue Bridge. Bay Ridge channel had been made 175 to 200 feet wide and 26 deep, an additional width of 175 to 200 feet being made 21 feet deep.

By the terms of the river and harbor act of 1896, the Bay Ridge and Red Hook channels, the triangular area between them, and Buttermilk channel were consolidated into one improvement, and a project for deepening the channels was adopted. This project was completed June 24, 1899, the channels being made 26 feet deep at mean low water, with widths as follows: Bay Ridge channel, 800 feet; the triangular area between Bay Ridge and Red Hook channels, maximum width of 900 feet; Red Hook channel, 400 feet; Buttermilk channel, at Red Hook shoal, 1,000 feet. Under the same project, also, Gowanus Canal, from Percival street to the Hamilton Avenue Bridge, was made 18 feet deep, with widths from 55 to 155 feet.

Under the terms of the river and harbor act of 1899, a project was adopted for making Bay Ridge and Red Hook channels 1,200 feet wide and 40 feet deep at mean low water, at a limit of cost of \$2,500,000, and under authority of the same act a continuing contract for the whole work has been entered into.

Harbor lines in Gowanus Bay and Buttermilk channel were established by the Secretary of War March 4, 1890. These harbor lines in the Gowanus Creek channel were slightly modified by act of Congress passed June 3, 1896.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Under the contract for making Bay Ridge and Red Hook channels 1,200 feet wide and 40 feet deep at mean low water, excavation was begun March 18, and up to the close of the fiscal year 284,501 cubic yards of material had been excavated; 28,288 cubic yards of this was sand removed from the outer end of the channel, 222,598 cubic yards of mud and sand were removed from the east side of the channel opposite Sixtieth street, Brooklyn, and extending 2,000 feet southward, and 33,615 cubic yards of mud were removed from the west side of the channel opposite Fiftieth street.

The contractors have now three dredges upon this work—a clam shell, a suction, and an endless chain or ladder dredge; they also have a large dipper dredge building and nearly finished. The clam-shell dredge is the only one that has yet been brought into condition for satisfactory work.

With part of the funds remaining from the appropriation of 1898 for a 26-foot channel, shoals in Buttermilk channel were deepened to 26 feet at mean low water. Offers were invited for the work and the lowest was accepted. The work was done by the W. H. Beard Dredging Com-

pany, in August, 1900, 9,168 cubic yards of material being removed, at price of 29 cents per yard. The rest of this appropriation, together with an allotment from the emergency appropriation of June 6, 1900, was applied to making the survey of Buttermilk channel authorized by act of Congress of June 6, 1900 (report printed as House Doc. No. 122, Fifty-sixth Congress, second session).

PRESENT CONDITION OF IMPROVEMENT.

Bay Ridge channel has been dredged 800 feet wide and 26 feet deep at mean low water throughout its length; great quantities of mud from the shoal banks on either side of the channel, especially on the east side, have run into the deep water, and the available width of full 26 feet depth is now from 600 to 800 feet.

The triangular area was dredged to 26 feet depth, with maximum width of 900 feet, and Red Hook channel to 26 feet depth and 400 feet width. Both retain the depth fairly well except near the banks, where there is from 1 to 3 feet shoaling.

Red Hook shoal, in Buttermilk channel, was dredged 26 feet deep from the deep-water channel west of the shoal eastward to 50 feet from the bulkhead, a width of about 1,000 feet. The rapid current prevents any noticeable deposit in this channel except in the cut nearest to the bulkhead.

The work done under the project of 1899 is not yet sufficiently advanced to have any useful effect upon the channel.

PROPOSED OPERATIONS.

Under the continuing contract now in force, excavation will be continued to make the channel of 40 feet depth contemplated in the project.

ESTIMATE OF AMOUNT REQUIRED UNDER CONTINUING CONTRACT DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

Under the terms of the contract the contractors were required to begin excavation within nine months from the date of approval of the contract. The contract was approved August 14, 1899, which fixes the time for beginning at May 14, 1900. The contractors found it necessary to build a new plant for this work, and the actual date of beginning excavation was March 18, 1901.

The amount of excavation required by the contract up to June 30, 1903, will be 9,460,000 cubic yards, which, at 10 cents per yard, would amount to \$946,000.

The contractors are behind in time of beginning work, and it is not probable that they will be able to excavate this amount by the date mentioned. It is estimated that a total of 7,000,000 cubic yards is a probable limit of the amount of excavation by June 30, 1903, and that about \$700,000 will cover the liabilities to be incurred up to that time.

The amount already appropriated for this project is \$502,000 and therefore it is estimated that a further appropriation of \$200,000 may be needed by June 30, 1903.

These channels are in the collection district of New York, of which New York City is the port of entry. The nearest light-house is the statue of Liberty Enlightening the World, on Bedloes Island, about $1\frac{1}{2}$ miles west. The nearest work of defense is Fort Columbus, Governors Island, New York.

Appropriations for improving Bay Ridge and Red Hook channels, and the triangular area between them, and Buttermilk channel, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.	
		Buttermilk channel, including Buttermilk and Red Hook shoals.	Bay Ridge, Red Hook, and Gowanus Creek channels.
Dredging	June 14, 1880	\$60,000	.....
Do.	Mar. 4, 1881	60,000	\$40,000
Do.	Aug. 2, 1882	60,000	20,000
Do.	July 5, 1884	10,000	5,000
Do.	Aug. 5, 1886	56,250	7,500
Do.	Aug. 11, 1888	100,000	60,000
Do.	Sept. 19, 1890	.....	160,000
Do.	July 13, 1892	100,000	198,600
Do.	Aug. 18, 1894	50,000	150,000
Total		496,250	641,100
Received from other sources		100	.....
Total		496,350	641,100

Total for previous projects, including dredging in Gowanus Canal, \$1,137,450.

For projects of 1896 and 1899.

Application.	Date.	Amount.
Dredging	June 3, 1896	\$200,000
Do.	June 4, 1897	350,000
Do.	July 1, 1898	130,000
Not yet expended	Mar. 3, 1899	100,000
Do.	June 6, 1900	262,000
Do.	Mar. 3, 1901	140,000
Total		1,182,000

Money statements.

BAY RIDGE AND RED HOOK CHANNELS.

July 1, 1900, balance unexpended	\$362,000.00	
November 26, 1900, received for services of steamer <i>Manisees</i>	55.00	
Amount appropriated by sundry civil act approved March 3, 1901	140,000.00	\$502,055.00
June 30, 1901, amount expended during fiscal year	12,839.90	
June 30, 1901, amount withdrawn for expenses office Chief of Engineers	400.00	
		13,239.90
July 1, 1901, balance unexpended		488,815.10
July 1, 1901, outstanding liabilities		10,779.40
July 1, 1901, balance available		478,035.70
July 1, 1901, amount covered by uncompleted contracts		2,189,675.60
{ Amount (estimated) required for completion of existing project		1,998,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901		200,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

BAY RIDGE, RED HOOK AND BUTTERMILK CHANNELS.

July 1, 1900, balance unexpended	\$7, 262. 46
June 30, 1901, amount expended during fiscal year	7, 262. 46

EMERGENCIES IN RIVERS AND HARBORS.

July 1, 1900, amount allotted	\$1, 250. 00
June 30, 1901, amount expended during fiscal year	1, 250. 00

CONTRACT IN FORCE.

For excavating Bay Ridge and Red Hook channels, 1,200 feet wide and 40 feet deep at mean low water, removing 22,000,000 cubic yards, more or less, at 10 cents per cubic yard, measured in scows.

Name of contractor, Hughes Brothers & Bangs, of Syracuse, N. Y.; date of contract, July 31, 1899; date of approval, August 14, 1899; date for beginning work, May 14, 1900; expiration of contract, indefinite, depending upon appropriations by Congress. Work in progress.

COMMERCIAL STATISTICS.

Statistics for the calendar year of 1900 have been asked for but have not been received in sufficient completeness to present a trustworthy estimate. The following statement for the calendar year of 1899 was collected with care and gives a fair representation of the commerce of these channels:

Freight received and shipped by water.

	Amount.	Estimated value.
Bay Ridge channel (sixty-ninth to Twenty-eighth street):	<i>Tons.</i>	
Receipts	505, 000	\$19, 625, 000
Shipments	138, 250	13, 225, 000
Red Hook channel (Henry street to Red Hook), no commerce reported except that of Erie Basin:		
Receipts	1, 293, 575	32, 664, 148
Shipments	1, 358, 000	40, 810, 000
Buttermilk channel (Red Hook to Atlantic avenue):		
On channel piers—		
Receipts	2, 464, 730	60, 439, 545
Shipments	2, 588, 000	75, 550, 000
In Atlantic Basin—		
Receipts	5, 654, 270	195, 898, 278
Shipments	5, 880, 000	326, 497, 000
Total	19, 881, 825	764, 708, 971

Vessels, not including tugs or ferryboats.

	Number.	Draft.	Tonnage.
Bay Ridge channel (Sixty-ninth to Twenty-eighth street):		<i>Feet.</i>	
Steam	283	5 to 26	50 to 3, 150
Sail	214	6 to 24	75 to 2, 000
Barges	3, 909	5 to 12	100 to 800
Red Hook channel, Erie Basin only:			
Steam	177	18 to 25	1, 500 to 5, 000
Sail	303	12 to 24	500 to 3, 000
Barges	6, 969		
Buttermilk channel (Red Hook to Atlantic avenue, including Atlantic Basin):			
Steam	1, 792	18 to 29	1, 000 to 6, 800
Sail	703	12 to 26	500 to 3, 000
Barges	43, 354		
Total	57, 704		

The above includes only freights received and shipped at the docks. In addition, 2,721,280 tons of freight are reported passing through these channels to and from Gowanus Creek, carried in 11,241 vessels of 4 to 25 feet draft.

Other freights pass through these channels to various destinations, the amounts of which there is no means of estimating.

G 3.

IMPROVEMENT OF GOWANUS CREEK CHANNEL, NEW YORK.

Gowanus Creek was originally a tidal inlet in the southern part of the city of Brooklyn emptying into Gowanus Bay. This creek has been improved by the United States as part of the improvement of Gowanus Bay, and for the purpose of the improvement the Gowanus Creek channel has been defined as extending from the junction of the Bay Ridge and Red Hook channels, opposite Henry street, Brooklyn, and Twenty-eighth street, South Brooklyn, eastwardly to the foot of Percival street, that part of the creek east of Percival street being called Gowanus Canal.

In 1880, before improvement by the United States, Gowanus Creek Channel had an available depth of about 11 feet at mean low water.

PROJECTS FOR IMPROVEMENT.

A survey of Gowanus Creek and Bay was made in 1880, and in 1881 a project for improvement was adopted providing for a channel in Gowanus Creek 18 feet deep at mean low water and 200 feet wide, which, with the Gowanus Bay channels, was estimated to cost \$182,500. After the depth had been made, under the terms of the river and harbor act of 1888, the project was extended to provide for a depth of 21 feet at mean low water. This depth was made between the harbor lines on either side of the creek under the river and harbor act of 1892, and the project was completed. At the time of completion of the project \$491,100 had been appropriated for and expended upon the several channels in Gowanus Bay. It is estimated that about \$75,000 of this sum was applied to the Gowanus Creek channel.

Under the river and harbor act of 1896, appropriating \$25,000 for improving Gowanus Creek channel, New York, by deepening the same to 26 feet at mean low water from the foot of Percival street to its junction with the Red Hook Channel, a project was adopted for making Gowanus Creek channel 26 feet deep at mean low water, at an estimated cost of \$70,000.

The channel was dredged 26 feet deep for width of 125 feet in 1897.

Harbor lines for the part of New York Harbor including Gowanus Creek channel were established by the Secretary of War March 4, 1890.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1900.

At the beginning of the fiscal year, dredging was in progress and nearly completed, under a contract with Henry S. Beard, of New York City; contract dated July 5, 1899; approved by the Chief of Engineers July 13, 1899; expiring under extension August 11, 1900. The contract was completed July 3, 1900. The amount dredged during the fiscal year was 1,740 cubic yards; the total amount dredged under the contract was 157,944 cubic yards.

The previously dredged channel of 26 feet depth at mean low water was widened on both sides to about 15 feet from the line joining the pier heads, and a few shoals at the entrance of the channel were removed.

PRESENT CONDITION OF IMPROVEMENT.

The channel has been dredged to 26 feet depth at mean low water for its full length, and with width extending to within 15 feet of the pier lines on either side. It can not be widened to the pier lines without endangering the pier heads. The middle part, 125 feet wide, has shoaled about 3 feet by deposition of soft mud. The sides, recently dredged, retain nearly the depth of 26 feet.

PROPOSED OPERATIONS.

Future appropriations will be applied to removing the shoals in the channel.

Gowanus Creek is in the collection district of New York. The nearest light-house is the Statue of Liberty Enlightening the World, on Bedloes Island, New York Harbor. The nearest work of defense is Fort Columbus, Governors Island, New York.

Money statement.

July 1, 1900, balance unexpended	\$7,353.19
June 30, 1901, amount expended during fiscal year	7,353.10
{ Amount (estimated) required for completion of existing project.....	20,000.00
{ Amount that can be profitably expended in fiscal year ending June 30,	
1903, in addition to the balance unexpended July 1, 1901.....	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

Appropriations for improving Gowanus Creek channel, New York Harbor, have been made as follows:

Application.	Date.	Amount.
For previous projects: Parts of the appropriations for Gowanus Bay channels, applied to Gowanus Creek, estimated to amount to about \$75,000; dredging to 21 feet depth.	Mar. 3, 1881, to July 13, 1892.	\$75,000
For the present project:		
Dredging 26 feet deep.....	June 3, 1896	25,000
Dredging 26 feet deep.....	Mar. 3, 1899	25,000
Total.....		125,000

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

With Henry S. Beard, of New York City, for dredging about 160,000 cubic yards, at rate of 14½ cents per cubic yard, measured in scows. Date of contract, July 5, 1899; date of approval, July 13, 1899; date of beginning work, October 10, 1899; expiration of contract, June 11, 1900; extended to August 11, 1900; contract completed July 3, 1900.

COMMERCIAL STATISTICS.

No statement of commerce for the past year has been received. The following statement, prepared for the year 1899, fairly represents the average commerce of Gowanus Creek.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1899.

Cargoes.	Tons.	Estimated value.
Receipts: Coal, lumber, steel, and general merchandise.....	179,300	\$1,848,390
Shipments: Miscellaneous (estimated).....	58,000	1,200,000
Total.....	237,300	3,048,390

Vessels engaged in above commerce.

Kinds of vessels.	Number.	Draft, loaded.	Tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steamers	740	6 to 25	75 to 1,800
Sail vessels	1,215	6 to 22	50 to 3,000
Barges, etc	3,110	5 to 12	200 to 1,400
Total	5,065		

The above refers to freight unloaded along Gowanus Creek, and is 21,948 tons more than reported for the year 1897. In addition to the above there was carried through Gowanus Creek, to and from Gowanus Canal, 2,041,980 tons of freight in 6,176 vessels of draft not exceeding 12 feet. Also 500,000 tons (estimated) of coal and lumber were taken into Columbia Basin, just inside the entrance of Gowanus Creek, there to be assembled in tows and dispatched to destinations.

No new lines of transportation are reported as established since July 1, 1900.

G 4.

ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK HARBOR.

The sundry civil act of March 3, 1901, contained the following item of appropriation:

Toward the enlargement of Governors Island, two hundred thousand dollars; and for the erection of storehouses and other necessary buildings, in accordance with the plan reported by a board composed of Major-General John R. Brooke, Colonel George L. Gillespie, and Colonel Amos S. Kimball, dated July twenty-first [August seven-teenth], nineteen hundred, sixty thousand dollars; in all, two hundred and sixty thousand dollars.

The report of the Board referred to recommended the construction of several buildings, of a wharf along the north shore of the island, with dredging to make an available depth of 26 feet at mean low water up to the wharf. It also provided for the construction of a bulkhead around part of the shoal south of the island, with filling to make land and increase the area of the island by about 90 acres, at a total cost estimated at \$885,000.

A project for the expenditure of part of the funds appropriated was submitted under date of June 14, 1901, and a general project for the entire work under date of June 18, 1901.

Money statement.

Amount allotted (act March 3, 1901)	\$200,000. 00
July 1, 1901, balance unexpended	200,000. 00
{ Amount (estimated) required for completion of enlargement (bulkhead and filling)	825,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901, for construction of bulkhead and filling.....	1500,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1901	\$200,000
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¹ Construction of storehouses and other necessary buildings not included.

G 5.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. *Wreck in Buttermilk channel, New York Harbor.*—This wreck was found in August, 1900, while making a survey of Buttermilk channel. It lay in water 36 feet deep, off pier 27, Brooklyn, and itself had a least depth of 23 feet. The obstruction was a dangerous one to the many vessels of great draft using that channel. Its removal was authorized by the Secretary of War August 28, 1900.

After inviting proposals by circular letter, agreement was made with John F. Baxter to remove and dispose of the wreck for the sum of \$325; and to purchase the hull and contents for the sum of \$15; net cost, \$310.

The contractor began work September 4; the wreck was lifted from the bottom by use of pontoons, and on September 11 it was towed to the contractor's private yard at Weehawken, N. J., and grounded at high water, behind the bulkhead line.

The boat was found to be a canal boat, about 96 feet long and 18 feet wide; her stern was completely stove in and port side broken. No evidence of the boat's name or registry could be found; she had been sunk several years; a few hollow floor tiles and fire brick were found in her hold.

2. *Schooner Grover Cleveland.*—This schooner was delivering a cargo of lumber to the Ordnance Department, at Sandy Hook N. J., November 9, 1900, when a strong northwest wind sprang up and the schooner filled and sunk at the Government pier. During the storm which followed the vessel partly broke up, her cargo and deck drifting ashore, and she lay alongside the pier obstructing the landing used for ordnance and heavy materials.

The schooner was a small boat, 56.4 feet length, and built in 1846. It was not worth to the owner the cost of removal, and he abandoned it. By authority of the Secretary of War, dated November 22, 1900, removal of the wreck was ordered; offers for doing the work was invited, and the offer of the R. G. Packard Company was accepted, proposing to remove and dispose of the wreck for the sum of \$385.

The contractor sent a dredge to the locality, pulled the wreck to pieces, placed it on a scow and deposited it on his private ground, behind the bulkhead line, at Bayonne, N. J. Nothing of value was found on the wreck.

G 6.

EXAMINATION AND SURVEY OF BUTTERMILK CHANNEL, NEW YORK HARBOR.

[Printed in House Doc. No. 122, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 1, 1900.

SIR: I have the honor to submit the accompanying copies of reports, dated respectively June 25 and November 28, 1900, with maps, by

Maj. W. L. Marshall, Corps of Engineers, upon preliminary examination and survey, made to comply with the provisions of the emergency river and harbor act of June 6, 1900, of Buttermilk channel, New York Harbor, with a view to obtaining a channel of the same width and depth as that contemplated by the project adopted for Bay Ridge and Red Hook channels.

The project for Bay Ridge and Red Hook channels contemplates securing a depth of 40 feet at mean low water, with width of 1,200 feet, these dimensions having been adopted by the terms of the river and harbor act of March 3, 1899.

Major Marshall is of opinion that a channel of very nearly, if not quite, the dimensions specified by the act of 1900 can be made without the expense of rock excavation, and the estimate presented contemplates the excavation of a channel of the required dimensions, so far as it can be done without requiring the removal of rock in place or of bowlders of over 5 cubic yards volume, which can not readily be handled by the usual class of dredges. The cost of the dredging work is estimated at \$1,900,000. The local officer states in this connection that the question of removing rock in place or bowlders of over 5 cubic yards volume should be considered in any contract that may be made on the basis of the estimate furnished, leaving the removal of such rock and bowlders to be provided for when their presence can be determined and, if found, their quantity estimated.

In his report on preliminary examination Major Marshall expressed the opinion that the proposed increase in the dimensions of Buttermilk channel would be an advisable work for the United States to undertake.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF BUTTERMILK CHANNEL, NEW YORK HARBOR, NEW YORK, WITH A VIEW TO OBTAINING A CHANNEL 40 FEET DEEP AT MEAN LOW WATER AND 1,200 FEET WIDE.

UNITED STATES ENGINEER OFFICE,
New York City, June 25, 1900.

GENERAL: I have the honor to submit the following report upon a preliminary examination of "Buttermilk channel, New York Harbor, with a view to obtaining a channel of the same width and depth as those contemplated by the project adopted for Bay Ridge and Red Hook channels," made under the provisions of act of Congress approved June 6, 1900.

The project adopted for Bay Ridge and Red Hook channels, under authority of the river and harbor act of 1899, contemplates a width of 1,200 feet and a depth of 40 feet at mean low water, and these are the dimensions in view in this examination.

Buttermilk channel is the southeasterly one of two channels connecting the East River with the main channel of New York Harbor. It extends along the Brooklyn water front southwesterly to Red Hook,

where it meets the Red Hook channel, and continues to the main harbor channel. The extreme length of Buttermilk channel from the 40-foot curve in East River to the 40-foot curve in the main channel is $2\frac{1}{4}$ miles. Throughout this length the channel had a natural depth of about 26 feet at mean low water, but the deep waterway was crooked, in many places narrow, and on account of the rapid current it was very difficult to follow. Improvements made under different projects adopted and completed since 1880 have resulted in making the 26-foot channel 1,000 feet wide.

Under provision of the river and harbor act of 1896, a survey was made with a view to deepening Bay Ridge, Red Hook, and Buttermilk channels so as to make one continuous channel 30 feet deep at mean low water and 1,000 feet wide, with an alternative proposition for depths of 35 feet and widths of 1,200 feet. The report on this survey was printed in the Annual Report of the Chief of Engineers for 1897, page 1178.

The piers and landings along Buttermilk channel are points for receiving, storing, and shipping large quantities of freight, grain, South American, Caribbean, Mediterranean, and miscellaneous goods. The freight terminals of the Ward Line, the Prince Line, the Anchor Line, and the Lamport & Holt Line are on this channel.

The commerce of Buttermilk channel consists of widely varying classes of goods, including large amounts of sugar and coffee, cotton, and other articles received and shipped to South American, Caribbean, and Mediterranean ports.

For the calendar year 1899 a fairly accurate statement of freights received has been obtained; no records of freights shipped are procurable. In previous years the shipments have exceeded the receipts by an average of about 10 per cent, and the same ratio may be assumed for 1899.

Commercial statistics for the calendar year 1899.

	Tons.	Estimated value.
Receipts	5,857,292	\$179,978,512
Shipments (estimated)	6,444,000	195,776,000
Total.....	12,301,292	373,754,512

Vessels arriving and departing (1899).

	No.	Draft.	Tonnage.
Steamers	1,246	<i>Feet.</i> 18-29	<i>Tons.</i> 1,000-6,800
Sail.....	507	12-26	500-3,000
Barges, etc.....	31,390	(a)	(a)
Total	33,143		

a No record.

The above statement is for cargoes and vessels at the several piers and landings. There is no means of making even an approximate estimate of the amount of freight which passes through this channel without touching at the landings.

In my opinion the improvement of Buttermilk channel, with a view to obtaining a channel of the same width and depth as those contem-

plated by the project adopted for Bay Ridge and Red Hook channels, would be an advisable work to be undertaken by the United States, both on account of the very large amount of commerce carried on in this channel and because until it is so improved the projected improvement of Bay Ridge and Red Hook channels will be of local use only, their availability as an entrance to East River being limited by the depth obtained in Buttermilk channel.

A survey of the channel, consisting principally of borings, will be necessary to determine the character of material existing down to the depth of 40 feet below mean low water. Nearly all the other data required can be obtained from previous surveys. It is impracticable, at any reasonable cost, to obtain complete information as to the character of material, and particularly as to the presence of rock, in a proposed channel of 40 feet depth and of great length and width. The survey contemplated would determine the kind of material at certain selected points, from which the general kind of material may be, with a fair degree of probability, inferred. A survey sufficient for this purpose is estimated to cost \$3,000. There is a balance of funds remaining from prior appropriations available for work in Buttermilk channel which will be sufficient for making this survey.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 25, 1900.

Respectfully forwarded to the Chief of Engineers, with recommendation that the survey be authorized at the estimated cost of \$3,000, the expenses to be defrayed from existing balances, which are ample for the purpose.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Division Engineer.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 30, 1900.

Respectfully submitted to the Secretary of War.

Under the provisions of the emergency river and harbor act approved June 6, 1900, a preliminary examination has been made of Buttermilk channel, New York Harbor (full text of item quoted within).

The locality is reported to be worthy of improvement, and I recommend that a survey be made and the cost of the improvement be estimated, the expenses of the survey to be paid from balance of former appropriations available for improving Buttermilk channel.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
*July 2, 1900.*Approved as recommended by the Chief of Engineers.
By order of the Secretary of War:JOHN C. SCOFIELD,
*Chief Clerk.*SURVEY OF BUTTERMILK CHANNEL, NEW YORK HARBOR, NEW YORK,
WITH A VIEW TO OBTAINING A CHANNEL 40 FEET DEEP AT MEAN
LOW WATER AND 1,200 FEET WIDE.UNITED STATES ENGINEER OFFICE,
New York City, November 28, 1900.

GENERAL: I have the honor to submit the following report upon the survey of Buttermilk channel, New York Harbor, made under authority of the Secretary of War, dated July 2, 1900, and pursuant to the provisions of the river and harbor act of 1900. This act authorized a survey of the channel with "a view to obtaining a channel of the same width and depth as those contemplated by the project adopted for Bay Ridge and Red Hook channels." This means a depth of 40 feet at mean low water with width of 1,200 feet, the dimensions for Bay Ridge and Red Hook channels specified in the river and harbor act of 1899.

Herewith is transmitted a map¹ showing accurately the present depths in Buttermilk channel and the location for the proposed channel of 40 feet depth and 1,200 feet width, and a supplementary chart showing the character of material ascertained by borings.

The borings were made with water jet throughout the proposed channel to ascertain the kind of material below the bottom. In the upper part of the channel it was found to be rather harder below the bottom than at the bottom, and the bank of bowlders along the Governors Island shore is somewhat more extended than had been anticipated. In the lower (south) part of the channel the material is soft to and beyond the depth of 40 feet. It is not expected that rock in place will be encountered within the limits of the proposed channel, but this can not be positively asserted because after considerable depth of penetration it is not possible by any method short of actual excavation to distinguish between ledge rock and bowlders. In any case, it is believed that a channel of very nearly, if not quite, the projected dimensions can be made without the expense of rock excavation. The estimate herewith contemplates the excavation of a channel of the full proposed dimensions so far as it can be done without requiring removal of rock in place, or of bowlders of over 5 cubic yards volume, which can not readily be handled by the usual class of dredges. This should be considered in any contract which may be made on the basis of this estimate, leaving the removal of rock in place and larger bowlders to be provided for when their presence can be determined and, if found, their quantity estimated.

The estimate of cost of excavating this channel is as follows:

Dredging 6,889,000 cubic yards of material, scow measurement, at average cost of 26 cents per cubic yard.....	\$1, 791, 140
Estimated cost of supervision and contingent expenses, about 6 per cent.....	108, 860
Total estimated cost.....	1, 900, 000

¹ Not reprinted; printed in House Doc. No. 122, Fifty-sixth Congress, second session.

The survey was made under the supervision of Mr. Henry N. Babcock, assistant engineer, whose report, transmitted herewith, contains further details of the work.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. HENRY N. BABCOCK, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
New York City, November 24, 1900.

MAJOR: I have the honor to submit the following report upon the survey of Buttermilk channel, New York Harbor, with reference to excavating it to a depth of 40 feet at mean low water, with width of 1,200 feet.

The survey was begun in August and completed in October, 1900. The accompanying map, scale 400 feet to the inch, shows the present condition of Buttermilk channel and the best location for a deep channel of the dimensions proposed.

The total length of such a channel is about 14,000 feet, extending from the 40-foot curve in East River, near the Wall Street Ferry crossing, to the 40-foot curve in the main channel, about $1\frac{1}{2}$ miles below the south end of Governors Island.

In addition to the soundings, borings were taken to determine the character of material to be excavated. The total number of locations of borings was 2,023; they were distributed most thickly in the upper part of the channel opposite Diamond and Coenties reefs, where the presence of ledge rock was most suspected. The borings were made with a water jet, using a Worthington pump $7\frac{1}{2}$ by 5 by 6 inch stroke, with 3-inch discharge reduced to 1 inch at the nozzle. The pump was mounted on the U. S. S. *Manisees*, and her derrick was used for handling the pipe, which for the length required weighed about 250 pounds. The steam pressure at the boiler averaged about 135 pounds; the water pressure at the pump discharge at its maximum was 125 pounds, but where the bottom was moderately soft the pressure was cut down. This apparatus worked rapidly in mud, sand, and gravel, and slowly in clay if not very stiff; where boulders were thick it could be sunk around and between them to a penetration of 8 to 15 feet, but below that depth it could not be depended upon. Turning aside from the stone, the pipe would run down obliquely, getting wedged between or abutting against boulders, and repeated trials in the same vicinity would give the same result at varying depths. The weakest part of the outfit was the couplings which join together the sections of pipe; no couplings could be found in the market which would stand the strain on a pipe 45 feet long. Special couplings made to order of mild steel and 6 to 8 inches long would have proven economical in the end.

The character of material to be removed is as follows:

In the upper part of the channel, above Red Hook, on the east side, sand and gravel to depths of 28 to 35 feet; below that, clay, and in front of Atlantic avenue, a small reef, probably hardpan; in mid-channel, sand and gravel, with occasional boulders; in the eddy, where the East River and Buttermilk tides meet, the sand is rather soft for a depth of 3 to 5 feet; on the west side, above Governors Island, is similar sand and gravel and occasional boulders. This is the section where ledge rock is apparently most liable to occur, and in several points the pipe could not be driven to 40 feet depth, but such points are more or less separated, and it seems probable that they indicate boulders rather than several peaks of ledge under the sand. Along the Governors Island shore the bank is full of boulders, and could not be penetrated to the required depth. There is no reason for suspecting rock in place.

South of Red Hook the bottom is sand or mud, generally quite soft and nowhere hard.

ESTIMATE OF AMOUNT OF EXCAVATION AND COST.

In estimating the amount of material to be removed in order to make a channel of the proposed depth and width, it is assumed that the banks of the channel will stand at a slope of 1 upon 4, that the unavoidable irregularities of bottom will be equivalent to 1 foot additional depth, and that the material will measure 25 per cent more in scows than in place.

Cubic yards.

Total excavation in place for channel of even depth of 40 feet, mean low water, and 1,200 feet wide, with side slopes of 1/4.....	4, 948, 000
Add for irregular bottom, equivalent to 1 foot additional depth.....	563, 000
Total yardage in place.....	5, 511, 000
Increase of bulk in scows, 25 per cent.....	1, 378, 000
Total excavation, measured in scows.....	6, 889, 000

Of this amount 1,890,000 cubic yards in place, equivalent to 2,360,000 yards in scows, or about one-third of the whole, may be classed as hard dredging, containing considerable amounts of clay and boulders, the other two-thirds being classed as comparatively easy of excavation. The demarcation between the two classes of material is of course not sharply defined, and the proportion is an estimated one.

There is no dredging plant already built in this vicinity which is capable of dredging to 40 feet depth with economy and of completing a work of this amount within a reasonable period, say four years. If the entire work were authorized under a single continuing contract, so that bidders would be warranted in planning to build a new plant or to alter or enlarge existing plants, a fair estimate of cost per yard, scow measurement, would be 18 cents for two-thirds of the work and 42 cents for the remaining third, being an average of 26 cents per yard for the entire work. It would be much higher than the rates obtained for Bay Ridge and Red Hook channels, both on account of the character of the material and the stronger tidal current. An offer might be made at lower price than 26 cents per yard particularly if experience shows that the Bay Ridge contract is a profitable one for the contractors. It is believed, however, that under present conditions the price mentioned is a fair estimate of probable cost.

6,889,000 cubic yards, at 26 cents per yard, measured in scows.....	\$1, 791, 140
Supervision and contingent expenses, about 6 per cent	108, 860
Total.....	1, 900, 000

The survey was made by a party under immediate charge of Mr. Glen E. Balch, surveyor.

Very respectfully, your obedient servant,

HENRY N. BABCOCK,
Assistant Engineer.

Maj. W. L. MARSHALL,
Corps of Engineers, U. S. A.

G 7.

MODIFICATION OF HARBOR LINES AT COLLEGE POINT, NEW YORK HARBOR, NEW YORK.

NEW YORK AND COLLEGE POINT FERRY COMPANY,
New York City, May 7, 1901.

SIR: Herewith send you a land and hydrographic survey¹ of the premises which we own at College Point, Long Island, and have shown thereon, as nearly as can be ascertained from your harbor line map, the established pier and bulkhead lines. We also show the proposed bulkhead and pierhead lines, as we would beg privilege to make application to you to establish in lieu of the present established lines at this place.

Both the proposed bulkhead and pierhead lines are about 30 feet westerly of the present established lines for that part of our premises running southeast. The direction for the proposed lines across the northerly end of our property to be about as shown on the accompanying plan.

¹ Not printed.

In making this request for a change in lines, it is with a view to improving our property along the westerly face, we desiring not to disturb the old crib, which forms our present westerly border, inasmuch as it has thoroughly settled and forms the foundation for all our structures and street terminals, which would have to be removed; in which case it would seriously inconvenience our ferry, besides requiring us to remove, by dredging and blasting, considerable of the natural ground on this line at an expense which we would not feel warranted in attempting.

We therefore make the request for an extension of 30 feet, as it is the least amount of ground upon which we can prepare for and place a crib at this locality, and at the same time retain our old foundation and crib.

As to the pierhead line, we have simply requested the same relative distance from the proposed bulkhead as is shown between the present established pier and bulk head lines, excepting that portion which runs in a northeasterly direction, in which case we request an extension outshore, inasmuch as we have found a number of shallow places which seem to be filled with bowlders, and should we, at any future time, desire to extend our ferry racks farther outshore we could accomplish this through application to the board of docks, city of New York, which privilege they can not grant at the present time. The shallow places are shown on the hydrographic portion of the survey.

The proposed bulkhead line will commence at a point located as follows: From a point of intersection of the westerly line of First street and the southerly line of Second avenue, running S. $86^{\circ} 51'$ E. 503 feet, which is the point of commencement of the proposed bulkhead line; thence running S. $86^{\circ} 51'$ E. to a point 30.38 feet distant; thence running on a line N. $5^{\circ} 57' 54''$ W. to a point distant 545 feet therefrom; thence running on a line $69^{\circ} 2' 6''$ E. a distance of about 95 feet, at which point it is to coincide with the present established bulkhead line.

The proposed pierhead line will commence at a point located as follows: From a point of intersection of the westerly line of First street and the southerly line of Second avenue, running S. $86^{\circ} 51'$ E. to a point distant 631.66 feet, which is the point of commencement of the proposed pierhead line; thence running on a line N. $5^{\circ} 57' 54''$ W. to a point distant 917 feet; thence of a line N. 55° about 190 feet, where it will coincide with the present established pierhead line.

Very respectfully, yours,

NEW YORK AND COLLEGE POINT FERRY COMPANY,
By WALTER C. FOSTER, *Vice-President.*

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, June 22, 1901.

GENERAL: The New York Harbor Line Board has considered the application of the New York and College Point Ferry Company for modification of the established pier and bulk head lines at College Point,

Long Island, referred by your indorsement of May 20, 1901, and has the honor to recommend that the existing harbor lines in the locality in question be modified as shown in full blue and broken blue lines on the accompanying lithographic map.¹ The modification herein recommended practically covers the extension asked for.

The following is a description of the lines thus recommended:

DESCRIPTION OF BULKHEAD LINE.

Beginning at a point in the bulkhead line approved by the Secretary of War January 9, 1891, in the westerly prolongation of the south side of Third avenue, 330 feet from the west side of First street; thence northerly in a straight line to a point in the westerly prolongation of the south side of Second avenue, 531 feet from the west side of First street; thence northerly in a straight line to a point in the westerly prolongation of the south side of First avenue, 598 feet from the west side of First street; thence northerly in a straight line to a point in a line 138 feet north of and parallel to the north side of First avenue, and 621 feet west of the west side of First street prolonged northerly; thence easterly in a straight line to a point in the bulkhead line approved by the Secretary of War January 9, 1891, said point being in the northerly prolongation of the west side of First street, 340 feet from the north side of First avenue.

DESCRIPTION OF PIERHEAD LINE.

Beginning at a point in the pierhead line approved by the Secretary of War January 9, 1891, in the westerly prolongation of the south side of Third avenue, 490 feet from the west side of First street; thence northerly in a straight line to a point in the westerly prolongation of the south side of Second avenue, 632 feet from the west side of First street; thence northerly in a straight line to a point in the westerly prolongation of the south side of First avenue 700 feet from the west side of First street; thence northerly in a straight line to a point in the westerly prolongation of a line 448 feet north of and parallel to the north side of First avenue 780 feet from the west side of First street prolonged northerly; thence in a straight line to a point in the pierhead line approved by the Secretary of War January 9, 1891, said point being in a line 1,130 feet north of and parallel to the north side of First avenue and 500 feet west of the west side of First street prolonged northerly.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.

S. M. MANSFIELD,
Colonel, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 26, 1901.

Respectfully submitted to the Secretary of War.

The New York and College Point Ferry Company request the modification of harbor lines at College Point, New York Harbor, established by the Secretary of War January 9, 1891, and confirmed November 6, 1891.

The request has been considered by the New York Harbor Line Board, which recommends in the within report that the existing lines

¹ Not printed.

be modified as shown in full blue and broken blue lines on the accompanying map, and described within.

I concur in the recommendation of the Board and suggest that the approval of the Secretary be placed upon this paper and upon the map which has been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,
June 28, 1901.

Approved as recommended by the Chief of Engineers.

E. ROOT,
Secretary of War.

APPENDIX H.

IMPROVEMENT OF DELAWARE RIVER AND BAY AND OF CERTAIN WATERS TRIBUTARY THERETO, NEW JERSEY, PENNSYLVANIA, AND DELAWARE, OF CERTAIN RIVERS AND HARBORS IN SOUTHERN NEW JERSEY AND IN DELAWARE, AND OF INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

REPORT OF LIEUT. COL. C. W. RAYMOND, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Delaware River, New Jersey and Pennsylvania. | 11. Goshen Creek, New Jersey. |
| 2. Schuylkill River, Pennsylvania. | 12. Wilmington Harbor, Delaware. |
| 3. Ice harbor at Marcushook, Pennsylvania. | 13. Appoquinimink River, Delaware. |
| 4. Construction of iron pier in Delaware Bay, near Lewes, Delaware. | 14. Smyrna River, Delaware. |
| 5. Delaware Breakwater, Delaware. | 15. Murderkill River, Delaware. |
| 6. Construction of harbor of refuge, Delaware Bay, Delaware. | 16. St. Jones River, Delaware. |
| 7. Rancocas River, New Jersey. | 17. Mispillion River, Delaware. |
| 8. Cooper Creek, New Jersey. | 18. Broadkill River, Delaware. |
| 9. Mantua Creek, New Jersey. | 19. Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Delaware. |
| 10. Alloway Creek, New Jersey. | 20. Removing sunken vessels or craft obstructing or endangering navigation. |

EXAMINATIONS AND SURVEYS.

- | | |
|-------------------------------------|---------------------------------|
| 21. Beach Thoroughfare, New Jersey. | 23. Smyrna River, Delaware. |
| 22. Mahon [Harbor] River, Delaware. | 24. Mispillion River, Delaware. |
-

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 19, 1901.

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1901.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

H I.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 877; 1897, page 1192; 1898, page 1075; 1899, page 1317; and 1900, page 1557. Expenditures during the past fiscal year have been applied to the following operations:

1. Surveys of the channel between the site of the proposed bulkhead near Reedy Island and the New Jersey shore; between Christiana River and Edgemoor; from Marcushook to League Island; from Gloucester to Fishers Point; south and east of Petty Island; from Torresdale to Andalusia, and from Bordentown to Trenton.

2. Removal of rock from the channel opposite Petty Island.

3. Improvement of Dan Baker shoal (subsection B, section 1).¹

These operations will be described in the above order. The localities referred to and previous operations thereat are described in the Annual Reports of the Chief of Engineers for 1896, pages 1076-1079, and 1899, pages 1317-1322.

1. SURVEYS.

Between the site of the proposed bulkhead near Reedy Island and the New Jersey shore.—This survey was made to determine the present condition of the channel between the site of the proposed bulkhead on Stony Point shoal and the New Jersey shore, as a basis for observing the changes that may occur at this locality after the completion of the bulkhead.

Between Christiana River and Edgemoor.—This survey, which included the main ship channel and the Delaware shore between Christiana River and Edgemoor, was made for the purpose of determining the location of pierhead and bulkhead lines for the westerly shore of the river between these limits.

From Marcushook to League Island.—This survey was made for the purpose of determining the shore lines between Marcushook and League Island, and included the hydrography back of Chester Island, and of the main channel between Thompson Point and Fort Mifflin.

From Gloucester to Fishers Point.—This survey was made to locate a new system of triangulation stations and to determine the shore lines of the Philadelphia and Camden water fronts as a basis for future hydrographic surveys of the river at this locality.

South and east of Petty Island.—This survey, which was commenced during the fiscal year ending June 30, 1900, was made to determine the changes which have occurred in the channel back of Petty Island, and to determine the changes in the channel and water front at the upper end of Philadelphia Harbor.

Between Torresdale and Andalusia.—This survey was made for the purpose of determining the extent of the middle ground shoal, which obstructs the river at this locality.

¹ The sections referred to herein are shown on the map accompanying the report of the Board of Engineers dated September 8, 1899, and printed in the Annual Report of the Chief of Engineers for 1900, page 1618.

Between Bordentown and Trenton.—This survey was made in August, 1900, for the purpose of determining the present condition of the river from Bordentown to the head of tide at Trenton.

2. REMOVAL OF ROCK OPPOSITE PETTY ISLAND.

A project for the expenditure of \$125,000 of the appropriation made in the river and harbor act of March 3, 1899, to be used for removing rock from the channel of the river opposite Petty Island (above Christian street, Philadelphia), was submitted on June 6, 1899, and approved June 14, 1899.

Under date of August 11, 1899, a contract was entered into with P. Sanford Ross, Incorporated, of Jersey City, N. J., for the removal of about 6,499 cubic yards of rock in the channel of the river at this locality, together with the overlying and adjacent material, so as to form a clear channel with a least depth of 26 feet at mean low water. Work under this contract was commenced on October 7, 1899, and is still in progress.

During the past fiscal year 18,063 cubic yards of rock and overlying material, scow measurement, have been removed from the ledge, making a total of 18,895 cubic yards to date. The removal of this material represents the removal of about 5,986 cubic yards of ledge rock, place measurement. The improvement will be completed during the present season.

3. IMPROVEMENT AND SURVEY OF DAN BAKER SHOAL (SUBSECTION B, SECTION 1).

A project for the expenditure of funds available for the improvement of the river between Christian street and deep water in Delaware Bay was submitted on September 25, 1899, and approved September 29, 1899. This project is in accordance with the report of the Board of Engineers dated September 8, 1899, and approved by the Secretary of War September 20, 1899, which provides for a channel 600 feet wide and 30 feet deep from Christian street, Philadelphia, to deep water in Delaware Bay, and further provides for the application of the expenditure now authorized by law to the excavation of the channel through subsection B of section 1 to a full depth of 30 feet at mean low water, with a width as great as can be formed with the funds available, not exceeding 600 feet, and to the construction of so much of the bulkhead required for the formation of the proposed island as is necessary to form a basin for the deposit of the material so excavated.

Under date of January 27, 1900, a contract was entered into with the Virginia Dredging Company, of Richmond, Va., for the removal of about 2,323,000 cubic yards of material to form a channel through the shoal in subsection B, section 1 (near Reedy Island), to a depth of 30 feet at mean low water over a length of 20,500 feet, and to a width as great as can be formed with available funds not exceeding 600 feet, together with the construction of about 11,700 linear feet of bulkhead to form a partly inclosed basin for the reception of dredged material. This contract is in accordance with the above-mentioned project.

Work under this contract was commenced on April 4, 1900, by the driving of piles for the construction of the proposed bulkhead. On June 30, 1901, 8,140 linear feet of bulkhead had been completed and

accepted and an additional length of 2,200 feet had been partly constructed. The work of dredging was commenced on August 22, 1900, and up to the close of the past fiscal year 1,004,338 cubic yards of material, scow measurement, had been removed under the contract, thereby forming a channel 30 feet deep at mean low water, about 18,900 feet long, with a width of from 50 to 300 feet through a part of Dan Baker shoal.

An additional quantity of material amounting to 85,650 cubic yards, dipper measurement, had been cast over against the inner face of the accepted bulkhead to form a backing for the structure.

Owing to the soft nature of the material which is being dumped behind the bulkhead, the backing has a tendency to slide. A project was therefore submitted on June 18, 1901, and approved June 20, 1901, for the construction of buttresses of rough riprap stone at intervals along the outer face of the bulkhead in order to give stability to the structure, at an estimated cost not to exceed \$50,000. It is expected that work under this project will be commenced during the present working season.

The project approved September 29, 1899, also provided for the reservation of \$18,400 from the appropriation of June 3, 1896, for the repair and maintenance of dikes. No expenditure has been made during the past fiscal year from this allotment.

It is proposed to expend available funds on the completion of work under existing contracts and under the project approved June 20, 1901. Future appropriations will be applied to further work under the general project.

Up to June 30, 1901, thirty-one wharves between Allegheny avenue and Moore street, on the Delaware River water front of the city of Philadelphia, had been extended to the new pierhead line, and between Pearl and Mickle streets, Camden, five wharves had been similarly extended to the New Jersey pierhead line.

During the past fiscal year three piers on the Philadelphia water front within the limits of the Philadelphia Harbor improvement were extended fully to the new line, and permission was given by the board of port wardens for the extension of two others. Two piers are now under construction.

The city of Philadelphia has constructed a new bulkhead along the bulkhead line from Vine to South streets, which has permitted the widening of Delaware avenue at that locality to 150 feet. The work of widening Delaware avenue between Vine and Green streets, has been authorized, but no appropriations have yet been made for commencing this work.

Detailed information with reference to these subjects is given in a letter dated June 24, 1901, from Mr. Theo. C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

Under date of June 10, 1901, regulations for the use of the main ship channel of the Delaware River below Philadelphia were prescribed by the Secretary of War, under authority of section 4 of the river and harbor act of August 18, 1894.

The Delaware River is tributary to the following collection districts: Trenton, Philadelphia, Wilmington, and Bridgeton. The amount of revenue collected in these districts during the year ending December 31, 1900, was \$21,775,200.98.

Money statement.

July 1, 1901, balance unexpended	\$556,366.64
Amount appropriated by sundry civil act approved March 3, 1901	61,500.00
	617,866.64
June 30, 1901, amount expended during fiscal year	176,200.21
	441,666.43
July 1, 1901, balance unexpended	441,666.43
July 1, 1901, outstanding liabilities	37,710.20
	403,956.23
July 1, 1901, balance available	403,956.23
	126,227.39
July 1, 1901, amount covered by uncompleted contracts	126,227.39
(Amount (estimated) required for completion of existing project	5,310,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unex- pended July 1, 1901:	
For works of improvement	\$1,000,000.00
For maintenance of improvement	100,000.00
	1,100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	\$15,000	August 5, 1886	\$210,000
June 10, 1872	10,000	August 11, 1888	250,000
March 3, 1873	115,000	September 19, 1890	240,000
June 23, 1874	60,000	July 13, 1892	50,000
March 3, 1875	30,000	August 18, 1894	170,000
August 14, 1876	40,000	June 3, 1896	500,000
June 18, 1878	110,000	March 3, 1899	300,000
March 3, 1879	201,000	June 6, 1900	270,500
June 14, 1880	235,000	March 3, 1901	61,500
March 3, 1881	250,000		
August 2, 1882	286,000	Total	3,604,000
July 5, 1884	200,000		

Total amount appropriated on present project to June 30, 1901 \$500,000

EXPENDITURES.

Under previous projects	\$2,967,681.83
Under present project	194,651.74
Total to June 30, 1901	3,162,333.57

ABSTRACT OF CONTRACTS IN FORCE WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND OF EXPIRATION.

1. With P. Sanford Ross, incorporated, of Jersey City, N. J., dated August 11, 1899, and approved August 26, 1899, for excavation and removal of rock and overlying material in the Delaware River opposite the lower end of Petty Island. • Work to be commenced on or before October 27, 1899, and completed on or before August 29, 1901.

2. With the Virginia Dredging Company, of Richmond, Va., dated January 27, 1900, and approved February 23, 1900, for dredging in the Delaware River near Reedy Island and constructing bulkhead for retaining dredged material. Work to be commenced between March 1 and April 15, 1900, and completed on or before October 31, 1901.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1899 and 1900, are compiled from reports of the board of trade, the commercial exchange, and the maritime exchange of the city of Philadelphia:

Articles.	1899.	1900.
IMPORTS.		
	<i>Tons.</i>	<i>Tons.</i>
Asphalt and asphalt blocks.....	11,739	14,588
Burlap.....		
Cement.....	23,006	10,904
Chalk.....	27,865	12,761
Clay.....	17,373	35,295
Coal.....	963	10
Coal tar, and pitch of.....	691	6,969
Cork and cork wood.....	485	853
Cotton and cotton fabrics.....	3,504	3,454
Drugs and chemicals.....	69,127	92,135
Earthenware, china and stone ware.....	162	210
Fertilizers.....	12,634	15,149
Fruits.....	21,632	16,810
Glass, and manufactures of.....	875	1,212
Glue and glue stock.....	1,786	1,763
Groceries and provisions.....	6,004	5,417
Hair, and manufactures of.....	1,167	1,019
Hemp, jute, flax, and their fabrics.....	28,978	27,425
Hides and skins.....	9,414	8,881
Iron:		
Manufactures of.....	8,054	7,641
Ore.....	421,187	511,958
Pig.....	13,617	28,950
Scrap.....	732	2,499
Leather, and manufactures of.....	194	226
Live stock and fowls.....	19	51
Mineral water.....	716	694
Molasses.....	16,528	26,474
Oil.....	1,222	2,059
Ores, metals, and manufactures of.....	1,281	2,435
Plants and seeds.....	4,099	3,646
Plaster of paris.....	15,108	26,458
Rags.....	2,280	2,272
Salt.....	5,359	14,766
Silk, and manufactures of.....	264	217
Stone, and manufactures of.....	2,091	2,677
Sugar.....	422,828	329,009
Sulphur, crude.....	9,861	8,231
Sulphur, ore.....	79,991	49,508
Tin.....	8,893	7,299
Tobacco.....	384	618
Wines and liquors.....	1,567	1,811
Wood pulp, paper, and manufactures of.....	1,431	10,394
Wood, and manufactures of.....	3,916	5,290
Wool and wool fabrics.....	6,560	9,973
Miscellaneous.....	4,853	6,543
Total.....	1,270,440	1,316,554
EXPORTS.		
Beef, pork and products.....	54,500	69,109
Bricks.....	3,743	28,715
Bran, middlings, and mill feed.....	20,190	21,528
Cars and locomotives.....	4,605	2,825
Coal.....	485,604	794,563
Corn and corn meal.....	827,663	937,621
Cotton and cotton fabrics.....	1,629	5,947
Drugs and chemicals.....	6,164	6,166
Fertilizers.....	956	644
Flour.....	222,775	230,514
Fruit.....	278	294
Glucose.....	8,801	10,087
Glue and glue stock.....	57	60
Groceries and provisions.....	11,048	19,133
Gunpowder and explosives.....	262	322
Hav.....	348	559
Hides, leather, and manufactures of.....	1,367	1,141
Iron:		
Manufactured.....	26,738	81,586
Pig.....	205	2,350
Scrap.....	68	3,946
Live stock.....	5,062	9,856
Metals, other, and manufactures of.....	5,549	16,452
Molasses.....	22,446	22,009

Articles.	1899.	1900.
EXPORTS—continued.		
	<i>Tons.</i>	<i>Tons.</i>
Oats and oatmeal.....	126,671	114,539
Oil cake.....	62,818	62,979
Oils, lubricating.....	72,854	47,575
Oil, other.....	739	2,568
Paraffin.....	14,022	16,877
Petroleum, crude and refined.....	851,145	756,134
Residuum.....	21,175	13,994
Rye.....	17,351	.....
Seeds.....	3,249	913
Soap, tallow, and grease.....	4,079	9,721
Stone, manufactured.....	8,903	11,323
Tobacco.....	5,232	5,575
Wheat.....	120,418	159,306
Wines and liquors.....	12	104
Wood pulp, paper, and manufactures of.....	792	309
Wood, and manufactures of.....	34,778	36,470
Miscellaneous.....	15,274	9,712
Total.....	3,069,570	3,513,526

Passengers arriving from and departing for foreign countries.

	1899.	1900.
Arrivals.....	26,981	19,817
Departures.....	5,926	6,552
Total.....	32,907	26,369

Comparative statement of tons and values of exports, imports, and revenue collected.

Year.	Exports.		Imports.		Revenue.
	Quantity.	Value.	Quantity.	Value.	
	<i>Tons.</i>		<i>Tons.</i>		
1893.....	1,816,297	\$43,416,955	1,154,814	\$58,870,186	\$9,899,284
1894.....	1,861,578	37,441,000	1,164,572	51,553,704	8,456,183
1895.....	1,738,913	36,745,119	1,355,456	47,271,435	13,526,966
1896.....	1,875,081	42,431,100	1,151,722	39,807,278	12,657,803
1897.....	2,599,952	51,760,616	1,182,807	27,921,738	14,057,074
1898.....	3,019,005	59,392,047	949,097	37,516,707	19,818,783
1899.....	3,069,570	67,044,250	1,270,440	48,241,016	20,777,735
1900.....	3,513,526	81,145,966	1,316,554	49,186,877	21,775,201

Foreign entrances and clearances.

Class.	Entered from foreign ports.				Cleared for foreign ports.				Total.	
	With cargo.		In ballast.		With cargo.		In ballast.			
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
American vessels:										
Steam.....	30	38,299	5	5,131	21	27,173	18	20,141	74	90,744
Sail.....	80	37,479	2	2,572	148	92,503	2	1,831	232	134,385
Foreign vessels:										
Steam.....	622	1,139,707	284	566,183	817	1,659,730	128	97,684	1,851	3,463,304
Sail.....	50	51,557	23	29,826	74	92,414	4	2,063	151	175,860
Total.....	782	1,267,042	314	603,712	1,060	1,871,820	152	121,719	2,308	3,864,293

1316 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1899 and 1900, has been compiled from returns made to this office by shippers, consignees, and carriers:

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
ARRIVALS.				
	<i>Tons.</i>		<i>Tons.</i>	
Asphalt.....	1,969	\$69,915	2,530	\$73,900
Brick and terra cotta.....	53,647	144,984	75,398	215,044
Cement and plaster.....	27,015	122,298	28,070	79,343
Chemicals.....	155,603	3,150,820	86,166	1,552,913
Clay.....			18,248	35,920
Coal.....	527,909	1,654,189	639,840	2,116,301
Coal tar.....			2,085	31,274
Cotton.....	8,127	1,148,050	7,469	1,483,790
Fertilizers.....	236,497	1,687,131	113,656	885,070
Grain.....	24,213	513,026	34,990	677,695
Hay.....	10,108	68,063	6,409	39,052
Ice.....	240,939	461,888	173,830	288,268
Iron:				
Manufactured.....	116,602	2,932,158	71,417	2,669,944
Ore.....	7,399	59,620		
Pig.....	179,925	2,875,095	143,756	2,382,395
Scrap.....	11,865	248,584	3,954	156,707
Lumber.....	502,549	9,901,674	678,265	7,555,519
Manure.....	22,572	22,634	29,285	33,096
Oysters and fish.....	21,160	802,520	23,313	905,900
Petroleum and products.....	149,406	2,669,180	203,220	3,114,712
Produce and fruit.....	60,736	1,172,416	19,376	740,842
Railroad ties.....	149,342	828,522	343,398	1,825,189
Sand.....	787,018	542,947	942,440	711,719
Stone:				
Building.....	451,456	952,042	66,271	858,502
Paving.....	125,926	205,796	79,944	186,160
Wood (cord).....	42,411	173,871	17,125	79,738
Miscellaneous.....	2,176,985	618,915,305	2,921,070	775,222,112
Total.....	6,091,379	651,322,728	6,731,525	803,920,605
DEPARTURES.				
Asphalt.....	1,969	68,915	11,646	274,730
Brick.....	32,107	118,969	59,503	176,428
Cement and plaster.....	3,709	22,638	2,955	23,061
Chemicals.....	81,792	2,085,405	76,467	1,782,854
Coal.....	7,322,026	25,453,590	8,025,877	27,801,651
Coal tar.....			7,784	116,757
Cotton.....	8,477	1,407,490	6,943	1,166,500
Fertilizers.....	211,435	1,856,433	153,010	1,527,521
Grain.....	9,271	195,831	9,545	215,515
Hay.....	6,198	38,573	3,909	25,232
Ice.....	85,157	150,314	49,432	81,449
Iron:				
Manufactured.....	128,681	5,438,186	106,870	4,829,835
Ore.....	7,399	59,620		
Pig.....	166,706	2,522,825	43,302	727,734
Scrap.....	663	9,945	200	4,343
Lumber.....	42,019	802,215	95,011	713,476
Manure.....	126,782	183,021	120,917	159,412
Oysters and fish.....	154,440	1,152,725	155,450	1,509,750
Petroleum and products.....	188,384	3,697,533	133,473	2,521,917
Produce.....	1,200	78,400	380	11,400
Sand.....	901,960	542,577	817,152	542,894
Stone:				
Building.....	17,314	82,219	331,632	465,906
Paving.....	12,975	47,450	31,640	58,086
Sugar.....	5,200	355,000		
Wood (cord).....	7,381	41,315	15,181	73,596
Miscellaneous.....	1,965,598	499,060,529	2,370,095	567,722,832
Total.....	11,488,843	545,471,658	12,628,374	612,532,879

Passengers arriving at and departing from Philadelphia.

	1889.	1900.
Arrivals.....	1,385,144	1,174,693
Departures.....	1,413,666	1,186,182
Total.....	2,798,810	2,360,875

Domestic and coastwise arrivals and departures in cargo.

Class.	1899.		1900.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers.....	a 17, 334	a 16, 118	a 14, 995	a 14, 976
Sailing vessels.....	4, 645	35, 944	4, 873	b 35, 682
Canal boats and barges.....	30, 416	44, 064	c 37, 016	d 46, 464
Rafts.....	81	303	926	458
Total.....	52, 476	96, 429	57, 810	97, 580

a Excluding tugboats and ferryboats.
b Including 31,600 oyster boats.

c Including 23,489 railroad lighters.
d Including 21,514 railroad lighters.

SUMMARY.

Freight movement.

	1899.		1900.	
	Tons.	Value.	Tons.	Value.
Foreign:				
Arrivals.....	1, 270, 440	\$48, 241, 016	1, 316, 554	\$49, 186, 877
Departures.....	3, 069, 570	67, 044, 250	3, 513, 526	81, 145, 966
Domestic:				
Arrivals.....	6, 091, 379	651, 322, 728	6, 731, 525	803, 920, 605
Departures.....	11, 488, 843	545, 471, 658	12, 628, 374	612, 532, 879
Total.....	21, 920, 232	1, 312, 079, 652	24, 189, 979	1, 546, 786, 327

Movement of vessels.

	Arrivals.		Departures.	
	1899.	1900.	1899.	1900.
Foreign trade:				
Steam vessels.....	881	941	895	984
Sailing vessels.....	190	155	170	228
Domestic trade:				
Steam vessels.....	17, 334	14, 995	16, 118	14, 976
Sailing vessels.....	4, 645	4, 873	35, 944	35, 682
Canal boats and barges.....	30, 416	37, 016	44, 064	46, 464
Rafts.....	81	926	303	458
Total.....	53, 547	58, 906	97, 494	98, 792

Freight movement of the port of Philadelphia for the year ending December 31, 1900.

	Arrivals.		Departures.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	<i>Tons.</i>		<i>Tons.</i>		<i>Tons.</i>	
Foreign.....	1, 314, 554	49, 100, 877	3, 513, 526	\$81, 145, 966	4, 828, 080	\$130, 246, 843
Domestic.....	6, 548, 155	776, 292, 912	11, 129, 461	520, 351, 632	17, 677, 616	1, 296, 644, 544
Total.....	7, 862, 709	825, 393, 789	14, 642, 987	601, 497, 598	22, 505, 696	1, 426, 891, 387

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE IMPROVEMENT BY THE CITY OF THE HARBOR OF PHILADELPHIA BY MEANS OF THE WIDENING OF DELAWARE AVENUE AND THE EXTENSION OF PIERS BY PRIVATE OWNERS DURING THE FISCAL YEAR ENDING JUNE 30, 1901, WITH TWO INCLOSURES.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, Pa., June 24, 1901.

DEAR SIR: I beg to acknowledge the receipt of your communication under date of May 25, 1901, in which you ask to be furnished with a concise statement regarding

the progress made by the city of Philadelphia on the reconstruction of the water front along the Delaware River and in the advancement of wharves to the new pier-head line by the city and private owners.

Under the head of improvement of the Delaware and Schuylkill rivers, I would state that no dredging in the channels of these rivers was done during the year 1900 by the city of Philadelphia, all dredgings under contract by the city having been completed by December, 1899.

Under contracts with the city work has been progressing upon the completion of the widening of Delaware avenue between Vine and South streets, including the construction of the bulkhead and the temporary paving upon the said widened avenue, the details of which are fully set forth in copy of communication inclosed herewith from Mr. George S. Webster, chief engineer and surveyor of the city, marked "Exhibit A."

In addition to this work upon the widened avenue the city of Philadelphia has had under course of construction during the past year a pier at the foot of Race street, intended to be utilized for commerce on the lower deck and to provide quarters for the harbor police, fire service, etc., and upon the upper deck to furnish a covered pavilion for recreation purposes. The limit of the contract amounts to \$105,000, and about 75 per cent of the work upon said contract has been completed.

Negotiations are approaching completion by the mayor of the city under an ordinance of councils approved April 1, 1899, which authorizes him to adjust with the owners of property affected such damage as may be caused in the matter of widening Delaware avenue between Vine and Green streets. When these negotiations have been completed a report will be made to councils and appropriations will be asked for for the actual work of construction upon the said widened avenue.

I take pleasure in inclosing herewith, marked "Exhibit B," communication from the secretary of the board of port wardens containing a list of licenses granted by the board for the extension of piers in front of the city of Philadelphia up to June 30, 1901.

Very truly,

THEO. C. KNAUFF, *Secretary.*

Lieut. Col. C. W. RAYMOND, *Corps of Engineers.*

EXHIBIT A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS, *Philadelphia, Pa., June 4, 1901.*

DEAR SIR: Replying to your letter requesting information covering the work done by the bureau in improving the channels of the Delaware and Schuylkill rivers, and also in connection with the reconstruction of the water front on the harbor, I would state that no work of dredging in the channels of the Delaware and Schuylkill rivers was done during the year 1900, all of which having been completed by December, 1899, although final estimate on the last Schuylkill contract, as stated in my last report to you, was not made until February 9, 1900.

In the matter of the reconstruction of the harbor front the following contracts were in force during the year:

Contract No. 13, which consisted in the dredging out of pier No. 10, North wharves, and the construction of a concrete bulkhead on the easterly line of Delaware avenue at the foot of Race street, with appurtenant work. Proposals for this work were received September 19, 1899. Award made to Daniel J. McNichol, the lowest bidder. Contract dated December 27, 1899. Limit of contract, \$20,000. The work was completed and final estimate drawn October 22, 1900. Total cost, \$19,172.45.

Contract No. 14, which consisted in the construction of a wooden pier at the foot of Race street, on the Delaware River, extending from the easterly line of Delaware avenue to the pierhead line, of similar construction to the piers built at Arch and Chestnut streets, and including the construction of circular wooden sewer 3 feet in diameter, supported by and fastened to the piles, to carry the drainage from the Race street sewer system to the pierhead line. Proposals were received September 19, 1899, and contract awarded to Armstrong & Printzenhoff, the lowest bidders. Date of contract, November 8, 1899. It was completed and final estimate drawn October 24, 1900. Total cost, \$65,697.44.

Contract No. 15, which provided for the paving, repaving, grading, filling, and draining incident to the widening of Delaware avenue. This work was supplementary to the work done under contract No. 7, and was intended to complete the temporary paving along the line. Proposals were received May 8, 1900. Award made to Daniel

J. McNichol, the lowest bidder. Contract was dated June 2, 1900. Limit of contract, \$36,000. The work was carried on at intervals during the spring and summer and completed December 20, 1900. Total cost, \$34,894.17. Payment made from the Girard estate fund.

Contract No. 16, which provided for depositing riprap for the support of the piles forming the substructure of the Race street pier. Contract made with Armstrong & Printzenhoff June 23, 1900. Work completed September 25, 1900, at a total cost of \$5,067.87.

Contract No. 17, for the construction of the superstructure for Race street pier, built under contract 14. This pier is intended to be utilized for commerce on the lower deck; also to provide quarters for harbor police and fire service. On the upper deck is provided a covered pavilion for recreation purposes. Proposals were received August 7, 1900. Contract made with Ryan & Kelley, lowest bidders, August 23, 1900. Limit of contract, \$105,000. About 75 per cent of the work on this contract has been completed. There has been paid to date on account the sum of \$58,075.60.

In the matter of the widening of Delaware avenue between Vine and Green streets, I would state that the ordinance of councils of April 1, 1899, provides that the mayor shall negotiate with the owners of property affected, with a view to determining the damage, and report to councils the result of the negotiations. Negotiations have been carried on and are approaching completion. After the report is made to councils an appropriation must first be made before any actual work of construction can be begun.

Yours, truly,

G. S. WEBSTER, *Chief Engineer.*

MR. THEO. C. KNAUFF,
Secretary Board of Harbor Commissioners.

EXHIBIT B.

BOARD OF PORT WARDENS FOR THE PORT OF PHILADELPHIA, PA., *Philadelphia, Pa., June 12, 1901.*

DEAR SIR: In compliance with your request of the 28th ultimo I send you below a list of the piers licensed by the board of wardens since June 30, 1900:

September 14.—Pennsylvania Railroad Company, to extend pier 46 south.

October 1.—Philadelphia and Reading Railway Company, to construct a pier at Port Richmond 180 feet east of Pier C.

March 4.—Pennsylvania Railroad Company, to build a pier at Greenwich.

June 3.—Philadelphia and Reading Railway Company, for the widening and extension of pier No. 27, north wharves to the port wardens' line.

Very truly, yours,

GEO. F. SPROULE, *Secretary.*

MR. THEO. C. KNAUFF,
Secretary Board of Harbor Commissioners.

H 2.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 915; and 1900, page 1570.

During the fiscal year ending June 30, 1900, no work was done in connection with this improvement and no expenses were incurred.

A project for the expenditure of the available balance of \$11,100 existing on June 30, 1900, was approved on July 5, 1900. This project provides for redredging the channel across the bar at the mouth of the river to a depth of 26 feet at mean low water over a width as great as available funds will permit, not exceeding 150 feet.

Under date of August 30, 1900, a contract was entered into with the

River and Harbor Improvement Company, of Camden, N. J., for the work required by the project.

During the past fiscal year operations under this contract were in progress from October 16, 1900, to November 24, 1900, when the work was completed. This work has resulted in the formation of a channel 26 feet deep at mean low water, and from 115 to 150 feet wide over a length of about 3,000 feet, through the bar at the mouth of the river. The total amount of the material removed under this contract was 55,068 cubic yards, scow measurement.

With the termination of work under this contract operations under the existing project for improvement were completed.

Under date of May 8, 1901, regulations were prescribed by the Secretary of War, under authority of section 5 of the act of Congress of August 18, 1894, for opening the draw of the Penrose Ferry Bridge, across the Schuylkill River.

During the years between 1895 and 1899, the city of Philadelphia was engaged in improving the channel of this river under authority of the Secretary of War, dated September 3, 1895, and May 14, 1896. These operations were completed in December, 1899, available funds having become exhausted.

The works of general improvement and the operations of the city of Philadelphia have resulted in the formation of a channel with a low-water depth of 26 feet and a width of from 115 to 150 feet through the bar at the mouth of the river, a channel with a depth of 22 feet at mean low water and a width of 250 feet from Penrose Ferry Bridge to Fifty-eighth street, near Gibson Point, except at Yankee Point, where the width is 300 feet. From a point opposite Fifty-eighth street the channel has a width of from 150 to 200 feet and a mean low-water depth of 20 feet to a point about 500 feet above Harrison's wharf.

During the fiscal year ending June 30, 1898, a survey of the river, made in accordance with the provisions of the river and harbor act of June 3, 1896, was completed from the mouth to Walnut Street Bridge, a distance of 7.39 miles, and a project for further improvement was submitted on March 5, 1898. The project provides for the formation, by dredging, of a channel with a depth of 26 feet at mean low water and a bottom width of 400 feet from outside the bar to Penrose Ferry Bridge ($1\frac{1}{2}$ miles), and thence a bottom width of 390 to 400 feet to Gibson Point (about 3 miles); from Gibson Point to Walnut Street Bridge (about 2.9 miles), for a channel 22 feet deep at mean low water and a bottom width varying from 320 to 400 feet. The total cost of the work was estimated at \$3,153,000.

This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1900, revenue to the amount of \$21,759,700.98. The nearest fort and light-houses are respectively Fort Mifflin and Schuylkill River range lights.

Money statement.

July 1, 1900, balance unexpended	\$11, 100. 00
June 30, 1901, amount expended during fiscal year.....	11, 100. 00

APPROPRIATIONS.

Act of—		Act of—	
June 11, 1870.....	\$15, 000	August 2, 1882.....	\$25, 000
March 3, 1871.....	10, 000	July 5, 1884.....	25, 000
June 10, 1872.....	40, 000	August 5, 1886.....	18, 750
March 3, 1873.....	40, 000	August 11, 1888.....	25, 000
June 23, 1874.....	20, 000	September 19, 1890.....	45, 000
March 3, 1875.....	20, 000	July 13, 1892.....	46, 250
August 14, 1876.....	20, 000	August 18, 1894.....	20, 000
June 18, 1878.....	30, 000	June 3, 1896.....	20, 000
March 3, 1879.....	25, 000		
June 14, 1880.....	40, 000	Total.....	525, 000
March 3, 1881.....	40, 000		

EXPENDITURES.

Total to June 30, 1901.....	\$525, 000
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COMMERCIAL STATISTICS.

The following statement of the foreign and domestic commerce of the Schuylkill River for the years ending December 31, 1899 and 1900, has been compiled from returns made by shippers, consignees, and carriers:

Movement of vessels.

Class.	1899.		1900.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers.....	148	555	178	434
Sailing vessels.....	314	172	167	214
Canal boats and barges.....	4, 858	3, 166	5, 090	3, 615
Total.....	5, 320	3, 893	5, 435	4, 263

Movement of freight.

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
ARRIVALS.				
	<i>Tons.</i>		<i>Tons.</i>	
Asphalt.....	13, 128	\$341, 280	15, 637	\$415, 710
Chemicals.....	35, 156	348, 869	28, 419	409, 566
Clay.....			5, 127	10, 254
Coal.....	459, 233	1, 599, 677	538, 506	2, 126, 516
Coal tar.....			12, 973	194, 595
Hay.....	1, 387	8, 325	1, 500	8, 250
Hemp and jute.....	4, 407	264, 420	5, 608	336, 180
Ice.....	84, 957	149, 914	49, 432	81, 449
Iron:				
Manufactured.....	275	9, 866	2, 363	115, 862
Ore.....	127, 300	1, 018, 400	78, 759	610, 072
Licorice root.....	3, 456	414, 720	12, 222	1, 045, 080
Lumber.....	3, 724	102, 209	14, 417	215, 232
Stone:				
Building.....	17, 864	111, 914	32, 451	312, 864
Paving.....	23, 497	44, 341	21, 032	45, 857
Sand.....	564, 088	298, 070	355, 656	260, 479
Wood (cord).....	13, 250	71, 643	13, 671	64, 596
Miscellaneous.....	38, 412	1, 921, 921	74, 452	686, 266
Total.....	1, 390, 134	6, 705, 569	1, 262, 225	6, 938, 828

Movement of freight—Continued.

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
DEPARTURES.				
	<i>Tons.</i>		<i>Tons.</i>	
Asphalt	1,969	68,915	1,643	54,790
Chemicals	41,624	433,012	2,127	40,223
Coal	122,485	384,355	18,530	79,679
Coal tar			5,328	79,923
Flour and meal	16,957	1,695,700	3,903	312,240
Grain	578,500	8,500,000	531,328	7,900,000
Iron, manufactured	5,478	324,525	12,895	656,700
Manure	50,272	61,234	29,285	32,996
Oil cake	5,205	135,330	11,287	293,462
Petroleum and products	1,136,616	17,109,652	952,528	18,162,528
Stone (paving)			12,746	14,389
Miscellaneous	134,582	4,205,399	131,129	1,250,979
Total	2,093,688	32,918,122	1,712,729	28,877,909

H 3.**IMPROVEMENT OF ICE HARBOR AT MARCUSHOOK, PENNSYLVANIA.**

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 918.

Since 1889 expenditures have been confined to maintenance and repairs. During the fiscal year ending June 30, 1898, two landing piers were repaired and a new mooring post placed, at a cost of \$700, including inspection and superintendence. The funds now available are considered sufficient for all probable necessities.

No work was done during the past fiscal year.

This work is located in the collection district of Philadelphia. This is the nearest port of entry, the collections during the year ending December 31, 1900, amounting to \$21,759,700.98. The nearest fort and light-house are, respectively, Fort Mifflin and Cherry Island, rear.

Money statement.

July 1, 1900, balance unexpended	\$1,715. 72
July 1, 1901, balance unexpended	1,715. 72

APPROPRIATIONS.

Act of—	Act of—
June 23, 1866	August 5, 1886
March 2, 1867	August 11, 1888
January 14, 1880	September 19, 1890
March 3, 1881	
August 2, 1882	Total

EXPENDITURES.

Total to June 30, 1901	\$212,284. 28
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H 4.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES,
DELAWARE.

An account of this work is contained in the Annual Reports of the Chief of Engineers for 1896, page 920, and 1900, page 1574.

The river and harbor act of June 3, 1896, appropriated \$7,660 for the maintenance and repair of this pier. Of this amount the sum of \$6,722.39 was expended for repairs during the fiscal year ending June 30, 1898; \$100 was expended during fiscal year ending June 30, 1899, for the construction of a storage platform near the head of the pier, and during the fiscal year ending June 30, 1900, the sum of \$17.01 was expended in making slight repairs to the pier superstructure.

During the past fiscal year no work has been done or liabilities incurred.

It is proposed to hold the sum of \$820.60, which remains available, for maintenance and repairs as needed.

The funds now available are considered sufficient for present needs.

This pier is in the collection district of Delaware, the nearest port of entry being Wilmington, where the amount of revenue collected during the year ending December 31, 1900, was \$15,500. The nearest fort and light-house are, respectively, Fort Delaware and Delaware Breakwater light.

Money statement.

July 1, 1900, balance unexpended	\$820. 60
July 1, 1901, balance unexpended	820. 60

APPROPRIATIONS.

Act of—		Act of—	
July 15, 1870	\$225, 000	June 14, 1880	\$10, 000
June 23, 1874	10, 000	March 3, 1881	10, 000
March 3, 1875	25, 000	August 2, 1882	13, 000
March 3, 1875	15, 000	April 4, 1890	10, 000
August 14, 1876	30, 000	June 3, 1896	7, 660
June 18, 1878	20, 000		
March 3, 1879	10, 500	Total	386, 160

EXPENDITURES.

Total to June 30, 1901	\$385, 339. 40
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H 5.

IMPROVEMENT OF DELAWARE BREAKWATER, DELAWARE.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 922; 1897, page 1214; and 1898, page 1094.

During the fiscal year ending June 30, 1899, a thorough examination of the breakwater was made. The final report on the work was sub-

mitted on June 19, 1899. This report is printed in the Annual Report of the Chief of Engineers for 1899, page 1346.

During the past fiscal year a survey of the Breakwater Harbor was made in June, 1901. From this survey it appears that the scouring which from the time of the completion of the breakwater up to June, 1899, had occurred over the entire protected anchorage site, has during the past two years been confined to the eastern half of that area, while over the western half shoaling has occurred. In the areas A, B, C, and D, referred to in the Annual Report of the Chief of Engineers for 1899, page 1354, the depths in sections A and B have decreased from 13.2 feet and 13.05 feet to 13 feet in both sections, while the depths in sections C and D have increased from 19.5 feet and 18.1 feet to 20 feet and 19.7 feet, respectively.

A comparison of the surveys of 1899 and 1901 shows that the resultant scour over the entire protected anchorage area in the past two years has amounted to 0.35 foot.

The funds now available are considered sufficient for present needs, and it is proposed to hold the sum of \$884.57, the available balance, for maintenance and repairs as needed.

The commercial statistics of the harbor at and in the vicinity of this breakwater are given in connection with the report on the harbor of refuge, Delaware Bay, Delaware.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the revenue collected during the year ending December 31, 1900, was \$15,500. Fort Delaware is the nearest fort, and the Breakwater light the nearest light-house.

Money statement.

July 1, 1900, balance unexpended	\$1, 056. 02
June 30, 1901, amount expended during fiscal year	171. 45
July 1, 1901, balance unexpended	884. 57

APPROPRIATIONS.

Act of—		Act of—	
May 7, 1822	\$22, 700. 00	June 23, 1866	\$107, 910. 00
May 23, 1828	250, 000. 00	March 2, 1867	109, 493. 70
April 23, 1830	162, 000. 00	August 2, 1882	125, 000. 00
March 2, 1831	208, 000. 00	July 5, 1884	75, 000. 00
July 3, 1832	270, 000. 00	August 5, 1886	56, 250. 00
March 3, 1833	270, 000. 00	August 11, 1888	100, 000. 00
June 28, 1834	270, 000. 00	September 19, 1890	80, 000. 00
March 3, 1835	100, 000. 00	July 13, 1892	50, 000. 00
July 2, 1836	100, 000. 00	August 18, 1894	50, 000. 00
July 4, 1836 (survey) ...	1, 000. 00	June 3, 1896	80, 000. 00
March 3, 1837	141, 000. 00		
July 7, 1838	150, 000. 00	Total	2, 808, 353. 70
August 30, 1852	30, 000. 00		

Total amount appropriated under present project to June 30, 1901..... \$616, 250. 00

EXPENDITURES.

Total to June 30, 1901	\$2, 192, 275. 15
Total under present project to June 30, 1901	615, 365. 43

H 6.

CONSTRUCTION OF HARBOR OF REFUGE, DELAWARE BAY, DELAWARE.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1897, page 1216.

During the fiscal year ending June 30, 1898, under a contract with Messrs. Hughes Bros. & Bangs, dated February 15, 1897, 289,709 tons of stone were deposited in the work, the total amount deposited to June 30, 1898, being 298,744 tons.

During the fiscal year ending June 30, 1899, under the same contract, 450,460 tons of stone were deposited in the work, the total amount deposited to June 30, 1899, being 749,204 tons.

During the fiscal year ending June 30, 1900, under the same contract, 345,895 tons of stone were deposited in the work, the total amount deposited to June 30, 1900, being 1,095,099 tons.

During the past fiscal year, under the same contract, 277,517 tons of stone were deposited in the work, the total amount deposited to June 30, 1901, being 1,372,616 tons.

The contract above referred to provides for the complete construction of the breakwater, to be paid for as appropriations may from time to time be made by law. It required the placing of 125,000 tons of stone during the year ending December 31, 1897, as estimated by the engineer officer in charge, under the terms of the contract, and for the continuance of the work as rapidly as may be required by the engineer officer in charge, to the extent of placing 280,000 tons during any one calendar year, provided sufficient funds are available for payment therefor. The work is required to be commenced on or before May 1, 1897, and to be completed on or before December 31, 1901, unless prevented by lack of funds.

On December 31, 1897, 131,106 tons of stone had been deposited in accordance with the terms of the contract. The condition of the work on June 30, 1901, was as follows:

Beginning at the stake light which was erected May 4, 1897, to mark the initial point of the upper part of the work, and running SSE. $\frac{1}{4}$ E. for a distance of 5,340 feet, and thence S. by E. a farther distance of 2,695 feet, making a total length of 8,035 feet, the substructure had been brought to a width of about 41 feet at mean low water. The superstructure had been constructed for a distance of 4,740 feet and partly constructed for a farther distance of 2,680 feet.

In addition to the construction of the breakwater, the project for the harbor of refuge provides for the construction of a row of ten ice piers across the upper end of the harbor to protect it from ice descending the bay.

A project for the construction of these ice piers was submitted on April 5, 1900, and approved by the Secretary of War on April 23, 1900.

Under date of September 7, 1900, a contract was entered into with Messrs. Hughes Bros. & Bangs, of Syracuse, N. Y., and approved October 2, 1900, for the complete construction of the ice piers. This contract provides for the complete execution of the work, to be paid for as appropriations may from time to time be made by law. It requires the placing of 64,500 tons of stone, the work to be commenced

on or before November 3, 1900, and to be completed on or before December 31, 1901, unless prevented by lack of funds.

Work under the contract was commenced in October, 1900, and up to the close of the fiscal year ending June 30, 1901, 39,562 tons of stone had been placed in the ice piers, thereby partly constructing the substructures of all ten of the piers and partly constructing the superstructures of two of them.

The funds on hand are considered sufficient for the completion of the work now projected under the two existing contracts.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the revenue collected during the year ending December 31, 1900, was \$15,500. Fort Delaware is the nearest fort, and the Breakwater light is the nearest light-house.

Money statement.

July 1, 1900, balance unexpended	\$722, 044. 47
Amount appropriated by sundry civil act approved March 3, 1901.....	213, 000. 00
	935, 044. 47
June 30, 1901, amount expended during fiscal year	496, 623. 56
July 1, 1901, balance unexpended	438, 420. 91
July 1, 1901, outstanding liabilities	93, 397. 88
July 1, 1901, balance available	345, 023. 03

APPROPRIATIONS.

Act of—		Act of—	
June 3, 1896.....	\$5, 000	June 6, 1900.....	\$450, 000
June 4, 1897.....	394, 334	March 3, 1901	213, 000
July 1, 1898	800, 000		
March 3, 1899	377, 000	Total	2, 239, 334

EXPENDITURES.

Total to June 30, 1901	\$1, 800, 913. 09
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CONTRACTS IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

1. With Hughes Bros. & Bangs, of Syracuse, N. Y., dated February 5, and approved February 20, 1897, for complete execution of the work of constructing a stone breakwater, to be paid for as appropriations may be made from time to time by law. To be commenced on or before May 1, 1897, and completed on or before December 31, 1901, unless prevented by lack of funds.

2. With Hughes Bros. & Bangs, of Syracuse, N. Y., dated September 7, 1900, and approved October 2, 1900, for complete execution of the work of constructing a row of ten ice piers, to be paid for as appropriations may be made from time to time by law. To be commenced on or before November 3, 1900, and completed on or before December 31, 1901, unless prevented by lack of funds.

COMMERCIAL STATISTICS.

During the year ending December 31, 1900, the following vessels called at Delaware Breakwater for the reasons given:

	Steamers.	Ships.	Barks.	Brigs.	Schoon- ers.	Barges.	Total.
For orders	52	12	23		4		72
For harbor	92	5	4	3	1,311	416	1,850
In distress					2		2
Total	144	17	27	3	1,317	416	1,924

In addition to the above, about 2,200 craft under 30 tons have used the breakwater for harborage.

H 7.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 925, and 1900, page 1578.

During the fiscal year ending June 30, 1900, under a contract with John L. Mills, of Camden, N. J., the work under the project approved April 8, 1899, was completed by the formation of a channel from 6 to 7 feet deep at mean low water, over a width of 30 feet for a length of 1,536 feet through the shoal below Moores landing. The quantity of material removed under the contract amounted to 5,879 cubic yards, place measurement.

During the past fiscal year no work has been done in connection with this improvement, the project having been completed by the exhaustion of available funds.

This work is situated in the collection district of Burlington, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1900. The nearest fort is Fort Mifflin, and the Horseshoe lights are the nearest light-houses.

Money statement.

July 1, 1900, balance unexpended	\$467.23
June 30, 1901, amount expended during fiscal year	67.53
July 1, 1901, balance unexpended	¹ 399.70

APPROPRIATIONS.

Below the Forks.

Act of—

March 3, 1881	\$10,000.00
August 2, 1882	10,000.00
September 19, 1890	10,000.00
	<u>\$30,000.00</u>

¹ Balance remaining from appropriation of August 18, 1894, and not available for expenditure under present project.

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Mount Holly Branch.

Act of—		
July 13, 1892.....	\$5,000.00	
August 18, 1894.....	3,000.00	
		\$8,000.00

Lumberton Branch.

Act of—		
June 3, 1896.....	2,000.00	
March 3, 1899.....	2,000.00	
		4,000.00
Total.....		42,000.00

EXPENDITURES.

Total to June 30, 1901.....	\$41,500.21
Carried to the surplus fund in July, 1890.....	100.09
Redeposited to credit of appropriation December 21, 1895.....	399.70

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1899 and 1900.

Kind of vessel.	Arrivals.				Departures.			
	1899.		1900.		1899.		1900.	
	Num- ber.	Tons.	Num- ber.	Tons.	Num- ber.	Tons.	Num- ber.	Tons.
Steamers.....	505	102,300	399	139,650	505	102,300	399	139,650
Sailing vessels.....	160	8,200	90	8,500	160	8,200	90	8,500
Barges and canal boats.....	1,624	454,730	998	306,386	1,624	454,730	998	306,386
Tugs.....			834	17,514			834	17,514
Pleasure craft, etc.....			160	1,600			160	1,600
Total.....	2,289	565,230	2,481	473,650	2,289	565,230	2,481	473,650

Freight statement.

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
ARRIVALS.				
	Tons.		Tons.	
Chemicals.....	3,800	\$26,000		
Coal.....	38,000	152,000	6,720	\$26,880
Fertilizer.....	3,000	16,000		
Iron, pig.....	5,000	100,000	3,399	67,980
Lime.....	12,000	22,000		
Lumber.....	300	6,350	1,900	28,500
Manure.....	63,000	94,500	21,952	34,300
Miscellaneous.....	6,100	300,000	12,000	942,857
Total.....	131,200	716,850	45,971	1,100,517
DEPARTURES.				
Clay.....			7,840	12,500
Fish.....	210	17,500	175	17,500
Produce.....	3,120	420,000	2,000	280,000
Sand and gravel.....	246,742	211,153	302,904	270,450
Miscellaneous.....	6,000	320,000	9,000	707,143
Total.....	256,072	968,653	321,919	1,287,593

H 8.

IMPROVEMENT OF COOPER CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 931; 1897, page 1123; 1898, page 1100, and 1899, page 1360.

During the past fiscal year no work has been done.

There is an available balance of \$8,823.90 remaining from the appropriation of June 3, 1896, which it is proposed to use under another contract in completing the improvement according to project as soon as the city of Camden removes or lowers the water pipe at State Street Bridge below the plane of proposed dredging. The pipe at its present height limits the draft of vessels and destroys the value of the improvement. The project can be completed with the funds now available.

This work is located in the collection district of Philadelphia. This is the nearest port of entry. The collections during the year ending December 31, 1900, amounted to \$21,759,700.98. The nearest fort and light-house are, respectively, Fort Mifflin and Upper Horseshoe range lights.

Money statement.

July 1, 1900, balance unexpended	\$8, 824. 85
June 30, 1900, amount expended during fiscal year	.95
July 1, 1901, balance unexpended	8, 823. 90

APPROPRIATION.

Act of June 3, 1896	\$37, 000
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EXPENDITURES.

Rebuilding dike on Government reservation in Delaware River at Woodbury Creek	\$2, 500. 00
Improvement of Cooper Creek, New Jersey	25, 676. 10
Total to June 30, 1901	28, 176. 10

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1899 and 1900.

Kind of vessel.	Arrivals.				Departures.			
	1899.		1900.		1899.		1900.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	76	22, 800	108	27, 000	76	22, 800	108	27, 000
Sailing vessels	154	61, 600	79	30, 400	154	61, 600	79	30, 400
Barges and canal boats	1, 134	232, 800	1, 099	274, 750	1, 134	232, 800	1, 099	274, 750
Total	1, 364	317, 200	1, 286	332, 150	1, 364	317, 200	1, 286	332, 150

Freight statement.

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
<i>Arrivals.</i>				
	<i>Tons.</i>		<i>Tons.</i>	
Asphalt.....	105	\$3,675	259	\$7,700
Brick.....	135	1,360	212	689
Chemicals.....	10,251	79,380	9,498	90,900
Clay.....	766	766		
Coal.....	51,776	140,013	53,414	157,427
Fertilizer.....	6,790	88,330	3,480	44,160
Grain.....	1,400	20,000	280	4,000
Hay.....	2,211	19,248	1,025	8,000
Iron:				
Pig.....	36,272	544,080	34,200	539,200
Scrap.....	663	9,945		
Lumber.....	300	6,300	1,200	13,200
Manure.....	25,750	38,075	29,362	43,600
Oil.....	8,078	130,977	5,586	107,433
Sand.....	15,949	11,585	10,565	9,352
Stone.....	650	650	637	637
Miscellaneous.....	2,215	135,452	3,150	143,025
Total.....	163,311	1,229,836	152,868	1,169,323
<i>Departures.</i>				
Chemicals.....	85	1,694	11,950	212,400
Fertilizers.....	9,680	193,600	4,700	96,800
Iron, manufactured.....	13,357	333,925	11,300	395,000
Produce.....	37,500	720,600	30,000	685,000
Miscellaneous.....	1,850	162,500	19,320	175,000
Total.....	62,472	1,412,319	77,270	1,564,200

H 9.

IMPROVEMENT OF MANTUA CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1899, page 1364.

The project for this improvement was adopted by Congress in the river and harbor act of March 3, 1899, which appropriated \$25,000 for the improvement, subject to the following provision:

Provided, That no part of any money appropriated for this project in excess of eight thousand dollars shall be expended for right of way privileges, easements, or other rights above the phosphate works and below Paulsboro, and no part thereof shall be expended for any such purpose unless all rights are secured for an amount not in excess of said sum of eight thousand dollars.

The negotiations for the right of way privileges, easements, and other rights above the phosphate works and below Paulsboro, which were carried on during the fiscal year ending June 30, 1900, resulted in the acquisition of the title in fee simple to the necessary property belonging to Mr. Howard W. Miller, after condemnation proceedings, and in the purchase of the necessary right of way through the lands of Mr. Matthew Gill. The sum of \$4,642.35 was paid to Mr. Miller and to Mr. Samuel E. Moore, mortgagee, on September 19, 1900, as the award for property taken, and the sum of \$3,357.65 was paid to Mr. Gill on the same date as the price of the right of way purchased from him. These payments were within the limit of \$8,000, as specified in the act, and secured all the necessary rights of way for the formation of the proposed cut-off channels between the phosphate works and Paulsboro.

Under date of September 24, 1900, a project was submitted for the expenditure of the balance of \$17,000 remaining from the appropriation of March 3, 1899, after paying for the necessary rights of way. This project provides for the formation of a channel 8 feet deep at mean low water and 80 feet wide at bottom from Paulsboro toward the phosphate works by way of the cut-offs as far as available funds will permit. This project was approved on September 28, 1900.

Under date of December 3, 1900, a contract was entered into with the American Dredging Company, of Philadelphia, Pa., and approved December 13, 1900, for the work required under the project.

During the past fiscal year operations under this contract were in progress from December 17, 1900, until April 8, 1901, when the work was completed.

The funds available were sufficient for the formation of all three of the cut-offs between Paulsboro and the phosphate works, together with the approaches to the same, and for the construction of the necessary meadow banks. By the work done 120,819 cubic yards of material, place measurement, were removed from the channel of the creek, of which 8,133 cubic yards were placed in the meadow banks constructed under the contract, and the remaining 112,686 cubic yards were deposited behind the banks on the meadows adjacent to the cuts. The total length of cut-off channel of the projected dimensions formed under the contract, as measured between the original low-water lines, was 2,590 linear feet, and the total length of meadow bank constructed along the line of the cut-off channels was 4,880 feet. The total cost of this work, including inspection and superintendence, was \$16,847.73.

This work is located in the collection district of Philadelphia. This is the nearest port of entry, the collections during the year ending December 31, 1900, amounting to \$21,759,700.98. The nearest fort and light-house are, respectively, Fort Mifflin and Tinicum Island range lights.

Money statement.

July 1, 1900, balance unexpended	\$25,000.00
June 30, 1901, amount expended during fiscal year	24,847.73
July 1, 1901, balance unexpended	152.27
{ Amount (estimated) required for completion of existing project	120,030.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	60,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of August 2, 1882	\$3,000
Act of March 3, 1899	25,000
Total	28,000

EXPENDITURES.

For land required	\$8,000.00
Under projects	19,843.73
Total to June 30, 1901	\$27,843.73

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COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1899 and 1900.

Kind of vessel.	Arrivals.				Departures.			
	1899.		1900.		1899.		1900.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers.....	1,154	62,854	1,140	61,500	1,154	62,854	1,140	61,500
Sailing vessels.....	776	65,800	792	70,400	776	65,800	792	70,400
Barges and canal boats.....	902	100,010	802	90,250	902	100,010	802	90,250
Car floats.....	136	20,400	164	27,500	136	20,400	164	27,500
Total.....	2,968	249,064	2,898	249,650	2,968	249,064	2,898	249,650

Freight statement.

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
ARRIVALS.				
	<i>Tons.</i>		<i>Tons.</i>	
Bricks.....	525	\$35,000	600	\$2,400
Chemicals.....	7,505	77,400	10,862	108,670
Coal.....	6,600	21,400	7,200	21,600
Fertilizer material.....	19,500	253,000	22,850	275,400
Hay.....	3,100	14,000	3,000	18,000
Lumber.....	5,200	144,500	5,000	100,000
Machinery.....	350	35,000	80	8,000
Manure.....	33,000	66,000	40,000	60,000
Salt.....	300	5,000	150	2,500
Sand.....	1,000	750	1,200	1,200
Stone.....	2,500	9,750	3,000	12,000
Miscellaneous.....	6,560	480,000	7,200	1,080,000
Total.....	86,140	1,141,800	101,142	1,689,770
DEPARTURES.				
Chemicals.....	1,910	25,500	840	4,200
Fertilizers (manufactured).....	24,350	390,750	29,475	421,300
Manufactured goods.....	3,650	160,000	4,200	175,000
Sand and gravel.....	14,100	14,100	15,000	15,000
Truck, produce, and grain.....	33,000	778,500	35,000	840,000
Wood (cord).....	400	1,200	300	1,200
Miscellaneous.....	2,100	42,000	3,000	150,000
Total.....	79,510	1,412,050	87,815	1,606,700

H 10.

IMPROVEMENT OF ALLOWAY CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 928, and for 1899, page 1358.

The river and harbor act of March 3, 1899, appropriated \$3,000 for continuing this improvement.

During the fiscal year ending June 30, 1900, under contract dated June 22, 1899, with the River and Harbor Improvement Company of Camden, N. J., the shoals at Smith Reeves, below the Square, below and above Robinsons Landing, Upper and Lower Fowlers, Upper and Lower Lamberts, and Quinton were dredged to a depth of 6 feet at mean low water over widths of 75 and 60 feet. The total amount of material removed under this contract was 14,690 cubic yards, place measurement, and the total length of channel improved was 5,412 feet. The total cost of the work, including inspection and superintendence, was \$2,923.46.

During the past fiscal year no work under this project has been done and no liabilities have been incurred. About four-fifths of the work provided by the project has been accomplished.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1900. The nearest fort is Fort Delaware, and the Reedy Island light is the nearest light-house.

Money statement.

{ Amount (estimated) required for completion of existing project.....	\$7,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	7,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
September 19, 1890	\$6,000	June 3, 1896.....	\$3,000
July 13, 1892	3,000	March 3, 1899	3,000
August 18, 1894.....	3,000	Total	18,000

EXPENDITURES.

Total to June 3, 1901	\$18,000
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COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1899 and 1900.

Kind of vessel.	Arrivals.				Departures.			
	1899.		1900.		1899.		1900.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers.....	65	7,200	65	7,400	65	7,200	65	7,400
Sailing vessels	20	2,000	20	2,500	20	2,000	20	2,500
Barges and canal boats	60	10,500	60	12,500	60	10,500	60	12,500
Total.....	145	19,700	145	22,400	145	19,700	145	22,400

Freight statement.

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
ARRIVALS.				
Coal.....	<i>Tons.</i> 9,500	\$22,500	<i>Tons.</i> 10,500	\$31,500
Glass sand	11,600	22,400	11,600	22,400
Lumber.....	3,000	35,000	3,000	37,000
Oyster shells	3,000	5,500	3,000	6,000
Soda ash	500	7,800	500	9,000
Tin plate.....	1,800	110,000	2,000	150,000
Miscellaneous.....	11,500	195,000	11,500	195,000
Total.....	40,900	398,200	42,100	450,900
DEPARTURES.				
Canned goods.....	9,000	400,000	9,500	400,000
Glassware.....	2,300	150,000	2,500	180,000
Grain.....	2,500	41,000	2,500	42,000
Produce.....	1,200	12,000	1,500	15,000
Ship timber.....	125	2,500	125	3,500
Miscellaneous.....	2,000	3,700	2,500	4,000
Total.....	17,125	609,200	18,625	644,500

H 11.

IMPROVEMENT OF GOSHEN CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 933; 1897, page 1225; 1898, page 1102; 1899, page 1362, and 1900, page 1585.

During the past fiscal year no work has been done in connection with this improvement.

It is proposed to hold the sum of \$841.72, which remains available, for maintenance and repairs which may become necessary from time to time. The funds now available are considered sufficient for all probable needs.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry at which no revenue was collected during the year ending December 31, 1900. The nearest fort is Fort Delaware, and the Maurice River light is the nearest light-house.

Money statement.

July 1, 1900, balance unexpended	\$841. 90
June 30, 1901, amount expended during fiscal year	. 18
July 1, 1901, balance unexpended	841. 72

APPROPRIATIONS.

Act of—		
July 13, 1892	\$3, 000	
August 18, 1894	3, 000	
June 3, 1896	3, 000	
March 3, 1899	8, 000	
Total	17, 000	

EXPENDITURES.

Total to June 30, 1901	\$16, 158. 28
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COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1889 and 1900.

Kind of vessel.	Arrivals.				Departures.			
	1899.		1900.		1899.		1900.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Sailing vessels	100	2, 500	.....	.....	100	2, 500	.....	.....

Freight statement.

Articles.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
ARRIVALS.				
	<i>Tons.</i>		<i>Tons.</i>	
Bricks.....	2,000	\$8,000	400	\$1,200
Coal.....	1,800	7,200	1,200	6,000
Fertilizer.....	1,200	15,200	500	6,000
Grain.....	5,500	115,500	2,500	50,000
Lumber.....	3,200	67,200	800	8,800
General merchandise.....	2,200	220,000	2,000	200,000
Total.....	15,900	433,100	7,400	272,000
DEPARTURES.				
Fertilizer.....	500	6,000	500	4,000
Hay.....	3,500	24,500	1,800	10,800
Oysters and clams.....	2,500	100,000	1,250	50,000
Potatoes.....	600	8,200	500	11,900
Sand.....	3,000	1,500	3,000	3,000
Wood.....	1,500	6,000	1,200	7,200
General merchandise.....	3,000	60,000	4,000	80,000
Total.....	14,600	206,200	12,250	166,900

H 12.**IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.**

[This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

The previous history of this improvement is contained in the Annual Reports of the Chief of Engineers for 1899, page 182, and 1900, page 208.

The work in progress at the close of the fiscal year ending June 30, 1900, under a contract dated November 11, 1899, with Benjamin T. Collins, of Milford, Del., for the construction of a pile and stone jetty 1,515 feet long on the south side of the mouth of the Christiana River, with a cross dike 1,170 feet long from the inner end of the jetty to the shore at high-water line, was completed on November 23, 1900. The contract price for this work was \$33,512.

The work in progress at the close of the fiscal year ending June 30, 1900, under a contract dated November 18, 1899, with the Sanford & Brooks Company of Baltimore, Md., for the repair and extension of the jetty on the north side of the mouth of the river and for the construction of a terminal crib, was completed on December 24, 1900. The contract price for this work was \$31,100.

Under contract with the New York Dredging Company, dated October 20, 1898, work upon which was commenced in December, 1898, the dredging of the channel above the Philadelphia, Wilmington and Baltimore Railroad bridge No. 4, to Newport, was completed on September 4, 1900. The channel was dredged to a width of 100 feet and a depth of 7 feet at mean low water at all places where this depth did not exist, thereby forming a channel of the projected dimensions from the point to which operations had been carried at the close of the fiscal year 1900, to Newport, a distance of about 14,500 feet. Upon the completion of this channel, operations were resumed at the Market Street Bridge, where the work of dredging through the north draw was completed on September 12, 1900. This work completed operations under the contract. The quantity of material dredged

under this contract from July 1, 1900, to its close, was 89,913 cubic yards, measured in place, and the entire quantity removed under it was 1,126,991 cubic yards, measured in place. The character of the material removed was mud, with some gravel, below the Market Street Bridge, and above that Bridge it was largely gravel and clay, with some mud at a few places. Through the Market Street Bridge the material was quite hard, including several bowlders and some broken rock. The depth dredged from the pulp works to the Delaware River, under the New York Dredging Company's contract, was 18 feet at mean low water.

Under the contract with the Bowers Hydraulic Dredging Company, of Camden, N. J., dated November 20, 1899, and approved December 15, 1899, for dredging a 21-foot channel, work under which was commenced on June 25, 1900, the section between the Philadelphia, Wilmington and Baltimore Railroad Bridge, No. 4, and the pulp works, in which the depth increases from 10 feet at the upper end to 21 feet at the lower end, was dredged to the projected dimensions; a channel 21 feet deep and 200 feet wide was dredged from the pulp works to the mouth of the Brandywine; a channel of the same depth and 250 feet wide was formed from the Brandywine to below Lobdell's Canal, and a channel of the same width and depth was dredged from the 21-foot curve of depth in the Delaware River for a distance of 1,800 feet inshore. The total length of continuous channel thus formed from Bridge No. 4 to below Lobdell's Canal is 19,745 feet, with an additional length of 1,800 feet at the mouth. The total quantity of material removed to date under this contract is 1,202,548 cubic yards, place measurement. This material was pumped ashore above high water on the meadows adjacent to the work.

The water main crossing the Christiana River at the Third Street Bridge, which, as stated in the annual report for 1900, projected at one end somewhat above the 18-foot depth, has since been lowered and is now 25 feet below the level of mean low water.

The work of removing rock from the channel of the river under the contracts and supplemental contracts with J. J. Fitzpatrick, of Plattsburg, N. Y., was continued. An additional ledge of rock was found during the past fiscal year just below the north draw of the Third Street Bridge, and a contract dated October 13, 1900, and approved October 31, 1900, was entered into with J. J. Fitzpatrick, of Plattsburg, N. Y., for its removal at \$10.99 per cubic yard, place measurement. Work under the latter contract was completed on June 28, 1901, the total quantity of rock removed from the ledge amounting to 354 cubic yards, place measurement. Operations on the other ledges were approaching completion.

An examination of the dredged channel between the pulp works and the mouth of the river made in June, 1901, shows that the areas dredged have rapidly shoaled. The present channel depths vary from 21 feet at the mouth, where dredging is still in progress, to 12 feet at the pulp works, where dredging was completed a year ago. At the pulp works the depth of the channel before dredging was 15 feet.

Money statement.

July 1, 1900, balance unexpended	\$281, 222. 52
June 30, 1901, amount expended during fiscal year	216, 029. 39
July 1, 1901, balance unexpended	65, 193. 13
July 1, 1901, outstanding liabilities	47, 121. 29
July 1, 1901, balance available	18, 071. 84
July 1, 1901, amount covered by uncompleted contracts	10, 597. 90
Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	50, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
July 14, 1836	\$15, 000	August 2, 1882	\$50, 000
March 3, 1837	8, 000	July 5, 1884	25, 000
July 7, 1838	9, 356	August 5, 1886	18, 750
July 11, 1870	15, 000	August 11, 1888	30, 000
June 10, 1872	10, 000	September 19, 1890	30, 000
March 3, 1873	6, 000	July 13, 1892	40, 000
June 23, 1874	6, 000	August 18, 1894	25, 000
March 3, 1875	10, 000	June 3, 1896	20, 000
August 14, 1876	16, 000	July 1, 1898	205, 846
June 18, 1878	7, 000	March 3, 1899	45, 000
March 3, 1879	3, 500	June 6, 1900	200, 000
June 14, 1880	10, 000		
March 3, 1881	50, 000	Total	855, 452

EXPENDITURES.

Total to June 30, 1901	\$787, 847. 65
Carried to surplus fund	2, 411. 22
	790, 258. 87
Total on present project	385, 652. 87

CONTRACT IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

With Bowers Hydraulic Dredging Company, of Camden, N. J., dated November 20 and approved December 15, 1899, for dredging in Wilmington Harbor and Christiana River, Delaware, to depth of 21 feet at mean low water. To be commenced June 25, 1900, and completed June 30, 1901. Extended by supplemental articles of agreement dated June 21 and approved June 29, 1901.

1338 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Commercial statistics of the city of Wilmington for the calendar year 1900.

[Furnished by the Wilmington Board of Trade.]

The tonnage and value of the leading articles shipped to and from the port of Wilmington by water during the year 1900 are as follows:

DOMESTIC COMMERCE.

Articles.	Quantity.	Value.
Coal.....tons..	46,200	\$116,475
Cord wood.....do..	4,725	18,800
Quarry stone.....do..	99,090	237,862
Sand, building and molding.....do..	52,775	28,975
Ice.....do..	3,460	6,240
Powder.....do..	2,690	36,725
Fertilizers.....do..	20,973	131,228
Iron supplies and steel.....do..	68,395	1,263,990
Lumber, sawed.....do..	25,230	201,225
Machinery.....do..	22,115	204,435
Cement.....do..	6,175	54,235
General merchandise.....do..	156,875	19,153,950
Miscellaneous.....do..	220,875	8,505,350
Total.....	729,578	29,959,490

FOREIGN COMMERCE.

Imports:		
Phosphate rock.....tons..	643	\$375
Nitrate of soda.....do..	6,890	183,978
Lumber, sawed.....feet B. M..	473,421	8,375
Total.....		192,728
Exports:		
Crude oil.....gallons..	104,829,800	5,679,735
General merchandise.....		74,433
Total.....		5,754,168
Total foreign imports and exports.....		5,946,896

There were engaged in foreign petroleum trade to and from this port (Marcus-hook) 33 steamers, making each a trip every six weeks, and of a total registered tonnage of 63,294. These statistics relative to foreign commerce were furnished by the Hon. William E. Cooper, collector of the port.

VESSELS TRADING IN WILMINGTON HARBOR NOT INCLUDED ABOVE.

Class.	Number.	Aggregate tonnage.	Draft.
Steamers.....	6	2,075	<i>Fect.</i> 6 to 10
Tugs.....	10	540	4 to 8
Schooners.....	12	680	Various.
Barges.....	22	10,105	Do.
Total.....	50	13,400	

The above vessels are engaged in the daily harbor and river work. There are many other vessels of various classes doing a general coastwise trade of which no correct record is kept. We have been trying to do this, yet it seems to be almost impossible. It is reported that there have passed in and out of the port during 1900 over a thousand steamers, barges, tugs, schooners, vessels, floats that are engaged in the business of the Christiana River and the trading incident thereto. There is invested in the freight and passenger line between Wilmington, Del., Philadelphia, Pa., and New Jersey towns and the towns on the coast down the State, over \$1,500,000. These vessels carry annually about 550,000 passengers and freight valued at about \$17,000,000.

There is invested in manufacturing and mercantile interests on the Christiana River, all dependent upon the facilities afforded for navigation in the Christiana River, at least \$16,000,000.

VESSELS BUILT.

Class.	Number.	Aggregate tonnage.	Draft.
STEEL.			
Freight and passenger steamer.....	1	2,827	16
Freight steamers.....	2	2,202	12½
Do.....	1	2,707	16
Freight barge.....	1	1,200	4
Gun barge.....	1	130	2
Barges.....	5	6,354	12
Tugs.....	3	676	7
WOODEN.			
Steamship.....	1	517	9
Steamship lighters.....	2	702	.....
Tugs.....	2	560	.....
Lighters.....	8	19,136	.....
Car floats.....	3	9,000	.....
Grain barge.....	1	800	.....
Oil tank barge.....	1	400	11
Derrick lighters.....	4	3,200	.....
Total.....	37	50,411	.....

VESSELS REPAIRED.

Steamers.....	348	53,108.36	.....
Sailing vessels.....	66	18,857.79	.....
Total.....	414	71,966.15	.....

H 13.

IMPROVEMENT OF APPOQUINIMINK RIVER, DELAWARE.

[This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1900, Part I, page 211.

During the past fiscal year no work was done in connection with this improvement owing to the exhaustion of available funds.

It is proposed to expend future appropriations in continuing the work of dredging under the project.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the year ending December 31, 1900, was \$15,500. Fort Du Pont is the nearest fort, and the Port Penn front light is the nearest light-house.

Money statement.

July 1, 1900, balance unexpended.....	\$87.93
July 1, 1901, balance unexpended.....	87.93

(Amount (estimated) required for completion of existing project.....	14,963.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$6,000.00
For maintenance of improvement.....	2,000.00
	8,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

1340 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

APPROPRIATIONS.

Act of—

September 19, 1890	\$5, 000
July 13, 1892	5, 000
August 18, 1894	5, 000
June 3, 1896	5, 000
March 3, 1899	5, 000

Total 25, 000

EXPENDITURES.

Total to June 30, 1901..... \$24, 912. 07

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, fertilizers, flour, etc	9, 120	\$173, 345
Horses, potatoes, etc	1, 110	69, 500
General merchandise	4, 350	652, 500
Total	14, 580	895, 345
Shipments:		
Canned goods	1, 425	92, 625
Fruit, wheat, poultry, sheep, etc	11, 085	693, 930
General merchandise	325	48, 750
Total	12, 835	835, 305
Total receipts and shipments	27, 415	1, 730, 650

Vessels trading in Appoquinimink River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			<i>Fect.</i>	
Steamer.....	1	136	7	Semiweekly.
Tugs	3	104	6 to 7	Transient.
Schooners.....	2	150		Transient, grain.
Barges	3	750		Transient, coal, etc.
Total	9	1, 140		

The above statistics were furnished by Mr. F. B. Watkins, Odessa, Del.

H 14.

IMPROVEMENT OF SMYRNA RIVER, DELAWARE.

[This work was in the charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

The previous history of this improvement is contained in the Annual Report of the Chief of Engineers for 1900, Part I, page 212.

During the past fiscal year no work was done in connection with this improvement, owing to the exhaustion of available funds.

Under the provisions of the emergency river and harbor act of June 6, 1900, a preliminary examination and a survey were made with a view to securing two crosscuts to shorten the distance between the head of navigation on this river and Delaware Bay. The reports upon them are printed in House Doc. No. 90, Fifty-sixth Congress, second session. The expenditure reported below as made during the year was on account of this examination and survey.

It is proposed to expend future appropriations in continuing the work under the project.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the year ending December 31, 1900, was \$15,500. Fort Du Pont is the nearest fort, and the Duck Creek light is the nearest light-house.

Money statement.

July 1, 1900, balance unexpended	\$460. 00
June 30, 1901, amount expended during fiscal year	207. 54
July 1, 1901, balance unexpended	252. 46
{ Amount (estimated) required for completion of existing project	4, 365. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$4, 365. 00
For maintenance of improvement.....	1, 000. 00
	5, 365. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Project of 1878.

Act of—	
June 14, 1880	\$5, 000
March 3, 1881	3, 000
August 2, 1882	2, 000
Total	10, 000

Project of 1887.

Act of—		Act of—	
August 11, 1888	\$10, 000	June 3, 1896	\$5, 000
September 19, 1890	5, 000	March 3, 1899	5, 000
July 13, 1892	3, 000		
August 18, 1894	5, 000	Total	43, 000

EXPENDITURES.

Total to June 30, 1901	\$52, 747. 54
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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, iron ore, steel, etc.....	8,000	\$87,900
Canned goods, flour, millwork, etc.....	10,528	222,800
Cattle, grain, horses, sheep, etc.....	63,705	432,825
General merchandise.....	10,000	400,000
Tot l.....	92,233	1,143,525
Shipments:		
Railroad ties, ship timber, etc.....	80,600	206,000
Canned goods, fertilizers, terra cotta, etc.....	133,145	903,500
Fruit, grain, cattle, poultry, etc.....	30,750	1,462,250
General merchandise.....	12,000	480,000
Total.....	256,495	3,051,750
Total receipts and shipments.....	348,728	4,195,275

Vessels trading in Smyrna River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			<i>Fect.</i>	
Steamers.....	3	285	5 to 6	{ Daily three months, then three trips weekly.
Steam barges.....	3	167	6	
Total.....	6	452		

Tugs *Jansen*, *Ivanhoe*, *Morgan*, and others were employed in shipment of wood, ties, and lime; also ten or more schooners and sloops carrying wood, lime, etc.

The above statistics were furnished by Mr. A. E. Jardine, secretary of the Smyrna Transportation Company.

H 15.**IMPROVEMENT OF MURDERKILL RIVER, DELAWARE.**

[This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

The previous history of this improvement is contained in the Annual Report of the Chief of Engineers for 1900, Part I, page 213.

No work was done in connection with this improvement during the past fiscal year, owing to the exhaustion of available funds.

It is proposed to expend future appropriations in continuing work under the project.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the year ending December 31, 1900, was \$15,500. Fort Delaware is the nearest fort, and the Mispillion River light is the nearest light-house.

Money statement.

July 1, 1900, balance unexpended	\$139.22
July 1, 1901, balance unexpended	139.22
{ Amount (estimated) required for completion of existing project	27,764.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.	
For works of improvement.....	\$7,000.00
For maintenance of improvement	1,000.00
	8,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—	
July 13, 1892	\$7, 000
August 18, 1894	16, 500
June 3, 1896	6, 500
March 3, 1899	5, 000
Total	25, 000

EXPENDITURES.

Total to June 30, 1901	¹ \$24, 860. 78
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COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, rock phosphate, ship timber, etc	5, 657	\$81, 630
Lime, fertilizers, dressed lumber, etc	5, 820	320, 750
Horses, hay, etc	1, 022	64, 700
General merchandise	900	324, 000
Total	13, 399	791, 080
Shipments:		
Cord wood, pine and oak piling	15, 020	30, 450
Canned goods, barrels, baskets, etc	17, 278	648, 000
Corn, wheat, fruit, cattle, etc	23, 972	575, 450
General merchandise	950	190, 000
Total	57, 220	1, 443, 900
Total receipts and shipments	70, 619	2, 234, 980

Vessels trading in Murderkill River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamer	1	350	<i>Feet.</i> 6½	Semiweekly.
Schooners	5	210	4 to 6	Weekly.

Other sailing vessels, whose draft is not known, trade in the river. One steamer and 5 sailing vessels of an aggregate of 540 tonnage repaired during the year.

The above statistics were furnished by Mr. Caleb J. Smithers, Frederica, Del.

H 16.

IMPROVEMENT OF SAINT JONES RIVER, DELAWARE.

[This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

A preliminary examination and survey of this stream were made during the fiscal year ending June 30, 1900, and the reports thereon printed in House Doc. No. 166, Fifty-sixth Congress, first session,

¹ Of this amount \$1,500 was expended in removing shoal at mouth of St. Jones River.

and in the Annual Report of the Chief of Engineers for 1900, page 1662. The improvement proposed is the formation, by dredging, of a channel 7 feet deep at mean low water, with a width of 100 feet at the mouth and a width of 60 feet inside the river from the 7-foot curve of depth in Delaware Bay to Lebanon, a distance of about 13 miles, together with the widening of the channel at bends and in existing cut-offs. The estimated cost of the improvement is \$47,074.50. This stream was under improvement between 1885 and 1890 and in 1895.

This project has not yet been adopted by Congress, but on July 2, 1900, an allotment of \$3,500 was made from the emergency river and harbor act of June 6, 1900, for dredging at the mouth of the river, where the channel had seriously shoaled, and for the expenditure of this money an open-market agreement was made with the Atlas Dredging Company, of Wilmington, Del., for dredging a cut 60 feet wide and 6 feet deep at mean low water from the 6-foot curve in Delaware Bay to the 6-foot depth in the river at 12 cents per cubic yard, place measurement, with no allowance for overdepth. This work was begun July 30 and completed August 14, 1900. The quantity of material removed was 22,960 cubic yards, and consisted of mud and sand, which was thrown over on the south side of the channel about 30 to 40 feet from the cut. The depth made ranged from 6 to $7\frac{1}{2}$ feet at mean low water. The amount expended was \$2,946.73. The remainder of the allotment was returned to the Treasury.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the year ending December 31, 1900, was \$15,500. Fort Delaware is the nearest fort, and Mahon River light is the nearest light-house.

Money statement.

July 2, 1900, amount allotted from the emergency river and harbor act of	
June 6, 1900	\$3,500. 00
June 30, 1901, amount expended during fiscal year.....	2,946. 73
	553. 27
November 27, 1900, amount redeposited to the credit of the appropriation.	

APPROPRIATIONS.

Act of—	
March 3, 1881.....	\$5,000
July 5, 1884.....	10,000
August 5, 1886	10,000
August 11, 1888	15,000
August 18, 1894.....	1,500
June 6, 1900 (allotment).....	¹ 3,500
	45,000
Total	

EXPENDITURES.

Total to June 30, 1901	\$44,446. 73
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¹ Of the above sum \$553.27 was returned to the Treasury.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Rawbone, phosphates, etc.....	6, 088	\$70, 312
Chemicals, flour, tinplate, etc.....	9, 629	477, 145
Garden truck, horses, sheep, etc.....	1, 687	179, 787
General merchandise.....	6, 725	1, 008, 750
Total.....	24, 129	1, 735, 994
Shipments:		
Railroad ties, sturgeon, oysters, etc.....	1, 223	169, 710
Canned goods, barrel material, etc.....	14, 324	613, 150
Fruit, grain, poultry, etc.....	27, 865	846, 975
General merchandise.....	1, 700	204, 060
Total.....	45, 112	1, 833, 835
Total receipts and shipments.....	69, 241	3, 569, 829

Vessels trading in St. Jones River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Passenger and freight steamer.....	1	107	<i>Feet.</i> 6	4 to 6 times weekly.
Steamer.....	1	100	6	Occasionally.
Tugs.....	2	45	5 to 6	Do.
Schooners and sloops.....	44	2, 298	3 to 6	Occasionally; some semi-weekly and regularly.
Barges.....	2	550	5½ to 6	4 times a day in season.
Total.....	50	3, 092		

Two thousand five hundred and seventy-eight passengers were carried between Philadelphia and St. Jones River during the year.

The above statistics were furnished by the Lebanon Navigation Company, Rising Sun, Del.

H 17.

IMPROVEMENT OF MISPELLION RIVER, DELAWARE.

[This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1900, Part I, page 215.

Under date of December 5, 1900, an allotment of \$1,050 was made by the Chief of Engineers, from the emergency river and harbor appropriation of June 6, 1900, to be applied to the work of restoring the channel depths in the Mispillion River. This allotment was applied to the removal of the crib dike which was built at the mouth of the river in 1895, and which had become undermined and unserviceable. A contract for the complete execution of this work, for the sum of \$876, was entered into with Wilson M. Vinyard of Milford, Del., under date of February 7, 1901. This contract was approved on March 6, 1901.

During the past fiscal year operations under this contract were in progress between February 25, 1901, and May 6, 1901, when work was

completed, the progress of the work having been considerably interfered with by stormy weather and accidents to the contractor's plant. This dike extended 325 feet in a southerly direction from a point about 350 feet north of the Mispillion light, and consisted of timber cribs, 25 feet long, 9 feet wide, and 10 feet high, loaded with stone, with a superstructure 4 feet high over the entire length. After the removal of the dike, a careful examination was made of the site of the structure, and no depth of less than 12 feet at mean low water was found over the area which it formerly occupied. The timber from the dike was placed on the adjacent marsh and the stone piled on the river banks above high water. The total cost of this work including inspection and superintendence was \$1,022.32.

Under the provisions of the emergency river and harbor act of June 3, 1900, a survey of this stream was made during the past fiscal year.¹ The estimate for the improvement of the river as stated therein includes the cost of removing the dike at the mouth, constructed in 1895. The authorization of the work of removing the dike and the allotment for the execution of the work were made subsequent to the submission of the report, and therefore the estimated cost of the improvement is affected accordingly.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the year ending December 31, 1900, was \$15,500. Fort Delaware is the nearest fort and the Mispillion light is the nearest light-house.

Money statement.

July 1, 1900, balance unexpended	\$962. 69
Amount allotted from emergency river and harbor act of June 6, 1900 ..	1, 050. 00
	2, 012. 69
June 30, 1901, amount expended during fiscal year	1, 819. 44
	193. 25
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—	
March 3, 1879	\$3, 000
June 14, 1880	4, 000
March 3, 1881	3, 500
August 2, 1882	3, 000
August 11, 1888	3, 500
	\$17, 000

Project of 1891.

July 13, 1892	\$12, 000
August 18, 1894	10, 000
March 3, 1899	2, 500
June 6, 1900 (allotment)	1, 050
	25, 550
Total	42, 550

EXPENDITURES.

Total to June 30, 1901	\$42, 356. 75
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¹ Printed in House Doc. No. 102, Fifty-sixth Congress, second session, and here-with as Appendix H 24.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Articles.	Tons.	Value.
Receipts:		
Rawbone, rock phosphate, etc.....	46, 075	\$606, 500
Chemicals, fertilizers, lumber, etc.....	1, 599	26, 275
Hay, fruit, grain, etc.....	4, 830	80, 500
General merchandise.....	18, 000	360, 000
Total.....	70, 504	1, 073, 275
Shipments:		
Railroad ties, timber, logs, etc.....	16, 255	62, 863
Canned goods, fertilizers, etc.....	9, 550	455, 000
Grain and fruit.....	8, 086	145, 000
Total.....	33, 891	662, 863
Total receipts and shipments.....	104, 395	1, 736, 138

Vessels trading in Mispillion River, Delaware.

Class.	Number.	Tonnage.	Draft.	Trips.
Steamer.....	1	130	<i>Fect.</i> 5½	Twice a week. Weekly.
Schooners.....	11	1, 250	4 to 7½	
Total.....	12	1, 380		

One steamer and 3 schooners of an aggregate tonnage of 1,505 were built, and 1 steamer and 15 sailing vessels of an aggregate tonnage of 1,670 were repaired, during the calendar year.

The above statistics were furnished by Mr. Benjamin T. Collins, of Milford, Del.

H 18.

IMPROVEMENT OF BROADKILL RIVER, DELAWARE.

[This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

The previous history of this improvement is contained in the Annual Report of the Chief of Engineers for 1900, Part I, page 216.

By authority of the Secretary of War, dated March 20, 1900, the Lewes River Improvement Company completed about August 1, 1900, at its own expense, an outlet from Broadkill Creek to Delaware Bay, by removing a point of land at the junction of the Broadkill with Lewes River, dredging a channel in Lewes River a distance of 2066 feet, and making a cut from the end of this dredged channel across the cape sands to the high-water line in Delaware Bay.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the year ending December 31, 1900, was \$15,500. Fort Delaware is the nearest fort, and the Delaware Breakwater rear range light is the nearest light-house.

It was not practicable to obtain any commercial statistics relating to this improvement.

APPROPRIATIONS.

Act of—		Act of—	
March 3, 1873	\$10,000	August 11, 1888.....	\$10,000
June 14, 1880	5,000		
March 3, 1881	5,000	Total.....	35,000
August 2, 1882.....	5,000		

EXPENDITURES.

Total to June 30, 1901.....	\$35,000
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H 19.

IMPROVEMENT OF INLAND WATERWAY FROM CHINCOTEAGUE BAY, VIRGINIA, TO DELAWARE BAY AT OR NEAR LEWES, DELAWARE.

[This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.]

The previous history of this improvement is contained in the Annual Report of the Chief of Engineers for 1890, Part I, page 217.

Under date of January 15, 1901, the Chief of Engineers approved a recommendation that the "middle" or Ocean Beach bridge, crossing the section of the waterway between Assawaman Bay and Indian River Bay, near Ocean View, Del., be repaired by the United States, at a cost not to exceed \$250, and that notice be given to the proper officials of the State of Delaware that the United States would not in the future repair the other two bridges crossing the waterway in this vicinity, or be in any way responsible for their maintenance. Notice to this effect was given to the levy court of Sussex County, Del., which has jurisdiction in this matter, under date of January 21, 1901. In accordance with the recommendation, the middle bridge was repaired and placed in good order during the month of March, 1901, at a cost of \$227.94.

The river and harbor act of June 3, 1896, appropriated \$25,000 for continuing this improvement. At the time of the passage of this act the question of the right of way for the canal was in litigation, and on August 18, 1896, the Secretary of War approved the recommendation of the Chief of Engineers dated August 15, 1896, that the appropriation be withheld from expenditure until this question should be passed upon by the courts. The United States has acquired the right of way everywhere along the route of the waterway except at the crossing of the Delaware, Maryland and Virginia Railroad at Rehoboth. The crossing has been condemned and the papers in the case were transmitted to the Attorney-General in May, 1899, for opinion as to their sufficiency. The Attorney-General has not yet rendered an opinion upon the question.

Under date of April 27, 1901, the Judge-Advocate-General passed upon the question as to whether the appropriation made in the river and harbor act of June 3, 1896, which contained the following proviso, viz:

"That no part of this appropriation shall be expended until the right of way is secured without cost to the United States, but the right of way over any railroad or through any railroad or county bridge shall not be subject to this proviso and may be secured by condemnation proceedings,"

could be expended in dredging between Indian River and the crossing of the Delaware, Maryland and Virginia Railroad at Rehoboth, as follows:

"It might be held that this proviso means that no part of this appropriation shall be expended until the entire right of way has been secured to the United States, but I am of the opinion that the better view is that the prohibition that 'no part of this appropriation shall be expended' applies only to that portion of the right of way secured without cost to the United States. If this be correct, the appropriation would be available although the portion of the right of way to be secured by condemnation has not been acquired."

Under date of May 2, 1901, the Secretary of War concurred in the views of the Judge-Advocate-General, and, under date of May 8, 1901, instructions were issued to submit a project for the execution of the work proposed to be done under his authority.

An examination of the waterway over this part of the route was made in June, 1901, and a project is now being prepared for the execution of the work. This project will be submitted early in July, 1901, with the view of having the work done either this fall or early in the spring of 1902. The examination shows that the condition of the work has not changed materially since the time of the last examination in 1896, except for the complete closing of the cut leading into the canal from Rehoboth Bay.

Money statement.

July 1, 1900, balance unexpended	\$26,494.72
June 30, 1901, amount expended during fiscal year	449.78
July 1, 1901, balance unexpended	26,044.94
July 1, 1901, outstanding liabilities	12.26
July 1, 1901, balance available	26,032.68
Amount (estimated) required for completion of existing project	156,250.00
Amount that can be profitably expended in fiscal year ending	
June 30, 1903, in addition to the balance unexpended	
July 1, 1901:	
For works of improvement	\$100,000.00
For maintenance of improvement	10,000.00
	110,000.00
Submitted in compliance with requirements of sundry civil act of June	
4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
August 5, 1886	\$18,750	August 18, 1894	\$25,000
August 11, 1888	50,000	June 3, 1896	25,000
September 19, 1890	50,000		
July 13, 1892	25,000	Total	193,750

EXPENDITURES.

Total to June 30, 1901	\$167,705.06
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H 20.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

During the past fiscal year twelve wrecks have been removed under the authority of the act of Congress approved March 3, 1899.

In September, 1895, the three-masted schooner *Lottie K. Friend*, with a cargo of coal, was sunk in Delaware Bay in collision with another vessel about $1\frac{1}{4}$ miles west from Ship John light. The wreck being considered a dangerous obstruction to navigation its removal was recommended. Under date of February 8, 1897, a contract was entered into with Thomas Poynter and Elijah D. Register, of Lewes, Del., for the removal of the wreck for the sum of \$1,100, the work to be completed on or before April 25, 1897. At the close of the fiscal year ending June 30, 1897, the removal of the wreck had been commenced, but had not been completed. During the fiscal year ending June 30, 1898, no additional work had been done toward the removal of the wreck under the above contract, and on June 16, 1898, it was recommended that the contract be annulled and the remaining wreckage be removed by dredging at some time when dredging operations were in progress in the neighborhood. This recommendation was approved on June 18, 1898. Since that time nothing has been done toward the removal of the wreck.

In March, 1900, the canal boat *Frank Dodson*, while loaded with coal, was sunk in Chester Creek, Pennsylvania, by striking a broken-off piling. The wreck when examined was found lying in the channel of Chester Creek about 500 feet above the mouth. The wreck being considered a dangerous obstruction to navigation, it was recommended that it be removed from the waterway. A contract for the removal of this wreck for the sum of \$245 was entered into with the River and Harbor Improvement Company, of Camden, N. J., under date of July 10, 1900, and approved July 27, 1900. The work of removal was completed in July, 1900.

In April, 1900, the two-masted schooner *Druzilla B. Lee* was burned to the water's edge while at anchor in Dennis Creek, New Jersey. The wreck, when examined, was found to be lying in the middle of the channel of Dennis Creek, New Jersey, about one-third mile above the mouth. The wreck being considered a dangerous obstruction to navigation, it was recommended that it be removed from the waterway. Under date of June 25, 1900, an informal agreement was entered into with C. H. Bowne, of Jersey City, N. J., for the removal of the wreck for the sum of \$93. Owing to the failure of Mr. Bowne to commence and complete the work of removal of this wreck, the agreement made with him was annulled on August 15, 1900, and an informal agreement for its removal for the sum of \$400 was entered into with Charles R. Mixner, of Goshen, N. J., under date of September 8, 1900. The work of removal under the latter agreement was completed in September, 1900.

In October, 1900, the steam tug *Fleetwing* was sunk in the channel of the Schuylkill River near its mouth. The wreck being considered a dangerous obstruction to navigation its removal was recommended. The owner of the vessel having had the wreck raised from the channel under a private contract and entirely removed from the waterway in

November, 1900, no action on the part of the United States toward the removal of this wreck was necessary.

In August, 1900, the canal boat *Daisy* was sunk in Rancocas River, New Jersey, one-fourth mile above Bridgeboro. The wreck being considered a dangerous obstruction to navigation its removal was recommended. Under date of December 7, 1900, an agreement was entered into with William D. Johnston, of South Boston, Mass., for the removal of this wreck for the sum of \$317. The work of removal was completed in January, 1901.

In September, 1900, the coal barge *Iron State* was sunk by collision in the Delaware River opposite Gloucester, N. J. The wreck being considered a dangerous obstruction to navigation its removal was recommended. The owners of the sunken vessel having taken action toward its removal under a private contract, operations on the part of the United States were withheld until January, 1901, pending the result of the owners' efforts. The owners having abandoned the wreck in January, 1901, after several unsuccessful attempts to raise it, a contract for its removal for the sum of \$1,575 was entered into by the United States with William H. Virden, of Lewes, Del., under date of January 25, 1901. The work of removal was completed in April, 1901.

In December, 1900, the hydraulic dredge *Potomac* was sunk in the Delaware Breakwater Harbor by foundering. The wreck being considered a dangerous obstruction to navigation its removal was recommended. The owners of the dredge having had the machine removed to a position where it is not a menace to navigation, no operations toward its removal have yet been undertaken by the United States. The allotment for the removal of the wreck will be held pending the final result of the owners' operations for its complete removal.

In December, 1900, an *unknown wreck* lying in the Delaware River below Riverton, N. J., was reported as being an obstruction to navigation. The wreck when examined was found to obstruct the waterway and its removal was therefore recommended. Under date of January 28, 1901, an agreement was entered into with the River and Harbor Improvement Company of Camden, N. J., for the complete removal of all parts of the wreck and its contents from the waterway for the sum of \$225. The work of removal was completed on March 21, 1901.

The contractors for this work having discovered and removed another unknown wreck in this locality before it was ascertained that it was not the wreck for the removal of which the allotment had been made, authority was requested under date of March 27, 1901, to pay the contractors the sum of \$100 from the balance remaining from the allotment for the removal of the unknown wreck in the Delaware River below Riverton, N. J., for the additional work of wreck removal performed by them. The authority to make this payment was approved under date of April 1, 1901, and the contractors were paid accordingly.

On January 19, 1901, the schooner *A. T. Coleman* was wrecked at the entrance to Absecon Inlet, New Jersey, during a storm. The wreck was subsequently broken up by the sea, and portions of the vessel and its cargo were washed ashore. The portions of the vessel remaining at the site of the wreck being considered a dangerous obstruction to navigation, their removal was recommended. Under date of February 23, 1901, an agreement was entered into with Charles P. Grim, of Philadelphia, Pa., for the removal from the waterway of all parts of the

vessel at or in the vicinity of the site of the wreck, for the sum of \$293. The work of removal was completed on June 4, 1901.

On February 20, 1901, one compartment of the hinged canal boat *Edward L. Meyers*, with a cargo of coal, was wrecked in the Schuylkill River, Pennsylvania, just below the South Street Bridge, Philadelphia. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of April 24, 1901, an agreement was entered into with Charles P. Grim, of Philadelphia, Pa., for the complete removal from the waterway of the wreck and its contents, for the sum of \$330. The work of removal was completed on May 27, 1901.

On February 7, 1901, one compartment of the hinged canal boat *Meadowbrook*, with a cargo of bituminous coal, was cut down by the ice in the Schuylkill River, Pennsylvania, and sank in the channel opposite the entrance to the reserve basin of the League Island Navy-Yard. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of April 27, 1901, an agreement was entered into with the River and Harbor Improvement Company, of Camden, N. J., for the complete removal from the waterway of all parts of the wreck and its contents, for the sum of \$300. The work of removal was completed on May 11, 1901.

On March 10, 1901, the schooner *I. W. Norris* was damaged by fire, and sank in Cedar Creek, New Jersey, just inside the mouth. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of April 17, 1901, an agreement was entered into with Truxton & Ross, of Georgetown, Del., for the complete removal from the waterway of all parts of the wreck and contents, for the sum of \$194. The work of removal was completed on May 9, 1901.

On April 24, 1901, the schooner *Mary Baxter*, with a cargo of sand, was sunk in collision with the steamer *Manhattan* in the main ship channel of the Delaware River below Billingsport, N. J. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of May 14, 1901, an agreement was entered into with the River and Harbor Improvement Company, of Camden, N. J., for the complete removal from the waterway of all parts of the wreck and its cargo, for the sum of \$600. The work of removal was completed on June 1, 1901.

About 1896, the schooner *Samuel Applegate* was sunk in Appoquinimink River, Delaware, below Odessa landing, on the edge of the dredged channel. The wreck being considered an obstruction to navigation, and being moreover the cause of a shoal in the channel, its removal was recommended. A contract for the removal of this wreck was entered into under date of April 20, 1901, with Truxton & Ross, of Georgetown, Del., for the sum of \$185. The work of removal was completed in May, 1901. This work was in charge of Gen. William F. Smith, United States agent.

In August, 1900, the canal boat *Zeus*, which had previously been wrecked in Smyrna River, Delaware, was examined and found to be an obstruction to the navigation of the stream. Its removal was therefore recommended. Under date of November 16, 1900, an agreement for the removal of the wreck was entered into with A. E. Jardine, of Smyrna, Del. At the close of the fiscal year ending June 30, 1901,

the work of removal was still in progress. This work was in charge of Gen. William F. Smith, United States agent, until May 15, 1901.

On June 3, 1901, the steamship *Ranald* foundered in the Atlantic Ocean off the New Jersey coast, about 3 miles south of the Absecon light, owing to the shifting of its cargo. The wreck being considered a dangerous obstruction to coastwise ocean traffic, its removal was recommended. This recommendation was approved, and at the close of the fiscal year preparations were being made to invite proposals for its removal.

The amount expended during the past fiscal year on the removal of wrecks is \$6,591.52.

H 21.

EXAMINATION AND SURVEY OF BEACH THOROUGHFARE, NEW JERSEY.

[Printed in House Doc. No. 94, Fifty-sixth Congress, second session]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 26, 1900.

SIR: I have the honor to submit herewith copies of reports dated June 22 and November 2, 1900, by Lieut. Col. C. W. Raymond, Corps of Engineers, upon preliminary examination and survey, respectively, of Beach Thoroughfare, New Jersey, made in accordance with requirements of the emergency river and harbor act of June 6, 1900.

Lieutenant-Colonel Raymond presents a plan for improvement of the locality by dredging a channel 6 feet deep, at mean low water, with a bottom width of 100 feet for a length of about 7,000 feet between 6-foot contours, together with widening the channel at bends as shown on the map, all at an estimated cost of \$36,000. In the opinion of Lieutenant-Colonel Raymond, the locality is worthy of improvement by the General Government.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF BEACH THOROUGHFARE, NEW JERSEY.

ENGINEER OFFICE, UNITED STATES ARMY,
Philadelphia, Pa., June 22, 1900.

GENERAL: In compliance with instructions contained in Department letter dated June 13, 1900, I have the honor to submit the following report upon a preliminary examination of Beach Thoroughfare, New Jersey, in accordance with a provision of the emergency river and harbor act of June 6, 1900.

A report upon the preliminary examination of this waterway was submitted to the Department on October 28, 1896, in accordance with

a provision of the river and harbor act of June 3, 1896. The present report is based upon data therein contained.

Beach Thoroughfare extends in a general northeasterly direction from Risley's channel, through which it connects with Great Egg Harbor and Egg Harbor Inlet, to Absecon Inlet. Egg Harbor Inlet is considered one of the best along the coast, and safer and with a greater depth than Absecon Inlet. Risley's channel is 2 miles long from the inlet to the beginning of Beach Thoroughfare proper, and through this 2 miles there is an excellent channel with a least depth of 12 feet at mean low water. The thoroughfare pursues a tortuous course through the flat marsh meadows, which are only 4 to 5 feet above mean low water; its width varies from 400 to 1,000 feet, and it has a length of nearly 7 miles from its beginning to Atlantic City. For the first 2 miles there is a good 12-foot channel, with depths in places as great as 29 feet. For the next 2 miles there is a 6-foot channel having an average width of 100 feet and a least width of about 60 feet. For a few hundred yards farther on there is a narrow 4-foot channel, and then for the next mile there is no channel through the thoroughfare. This shoal area is the place of the meeting of the tides between the two inlets. Through it the thoroughfare has a width of from 400 to 800 feet, with depths ranging from 0 to $1\frac{1}{2}$ feet. Beyond this shoal area a good 6-foot channel is found to Atlantic City, with an average width of 100 feet and a least width of 75 feet.

The majority of the boats which now use this thoroughfare are small sailboats drawing from 1 to 4 feet; during the summer months they pass through it in large numbers, carrying to Atlantic City vegetables, fruit, poultry, eggs, clams, oysters, hay, etc., from Great Egg Harbor, the Tuckahoe River, and points farther south along the New Jersey coast. Atlantic City has now a large permanent population, and during the summer it is the most crowded resort along the Atlantic coast, and therefore furnishes a desirable market for these products. Some of the boats engaged in this trade come from as far south as Chincoteague, Va. All these boats can cross the long shoal in Beach Thoroughfare—at extreme low tides it is sometimes entirely bare—only at high water, the average rise of tide being about 4 feet. They frequently run aground, or, missing one high water, have to wait until the next, a delay sufficient often to ruin their perishable cargo or to cause it to arrive too late for the market. This trade appears to be confined almost entirely to the summer months. Not only would the dredging of a channel through this shoal benefit and probably greatly stimulate the navigation of this locality, but if the project is ever carried out for a series of 6-foot channels to connect the inland waterways from Cape May to Great Bay, the channel through Beach Thoroughfare will be one link in the chain.

It is considered that a channel with a bottom width of 50 feet and a mean low-water depth of 6 feet will be ample for all the commercial purposes of the thoroughfare. In view of the large traffic which would be benefited and the probable moderate cost, I am of the opinion that this waterway is worthy of improvement by the General Government.

In the original report upon this examination it was stated that the locality having been surveyed in 1887, under the direction of Lieut. Col. Henry M. Robert, Corps of Engineers, no further survey would be required. A period of thirteen years has elapsed since the survey was made, and during this time changes have undoubtedly taken place

in the waterway. A resurvey of the locality for the preparation of a project and estimate based upon present conditions is now considered advisable. The cost of this survey is estimated at \$200.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 30, 1900.

Respectfully submitted to the Secretary of War.

Under the provisions of the emergency river and harbor act approved June 6, 1900, a preliminary examination has been made of Beach Thoroughfare, New Jersey.

A previous examination of the locality was made in 1896, and Lieutenant-Colonel Raymond again expresses the opinion that this waterway is worthy of improvement by the General Government.

I recommend that a survey of Beach Thoroughfare be made and the cost of improvement be estimated.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT, *July 3, 1900.*

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN C. SCOFIELD,
Chief Clerk.

SURVEY OF BEACH THOROUGHFARE, NEW JERSEY.

ENGINEER OFFICE, UNITED STATES ARMY,
Philadelphia, Pa., November 2, 1900.

GENERAL: In compliance with instructions contained in Department letter dated August 25, 1900, I have the honor to submit herewith a tracing¹ of a survey of a portion of Beach Thoroughfare, New Jersey, made under my direction, in accordance with a provision of the emergency river and harbor act approved June 6, 1900, by Mr. R. G. Pearson, United States surveyor, in September, 1900, and also to submit the following project for improvement:

Beach Thoroughfare lies wholly within Atlantic County, N. J., and extends in a general northeasterly direction about parallel to the coast line, from Risley's channel, through which it connects with Great Egg Harbor and Egg Harbor Inlet, to Absecon Inlet. It is separated from the ocean by Absecon beach, the site of Atlantic City, N. J. The thoroughfare has a length of about 6 miles from its beginning to

¹ Not printed.

Atlantic City, and pursues a tortuous course through the salt-marsh meadows, which are only from 4 to 5 feet above mean low water. Over this entire distance there is a navigable channel 6 feet deep at mean low water, except for a length of about 7,000 feet. This shoal area is the place of the meeting of the tides between the two inlets, and is the portion of the thoroughfare covered by the present survey.

In the portion of the thoroughfare under consideration the course of the waterway is quite direct, there being but one bend which is troublesome on account of its sharpness. The stream is bordered by salt meadows which are but slightly above average high tides, and which are often entirely submerged during storms. The banks of the meadows are steep down to the level of low tide and appear to be slowly eroding. The meadows are intersected by numerous creeks and ditches varying in width from 20 to 1,300 feet and averaging in depth less than 1 foot at mean low water. Throughout the area of the survey the stream has a width of from 400 to 800 feet, while the low-water depth within the same limits is generally about 1 foot. The bottom consists of a very soft mud, in which are embedded occasional oyster and clam shells, and in places it is covered with aquatic plants. This mud is reported as having a thickness of at least 6 feet, and is the material which will form the bottom of the dredged cut. The tidal currents, though distinctly perceptible, are not strong and have but slight carrying power; the flood current running south is more marked than the ebb current running north. The average range of tide was determined as 3.8 feet, or slightly less than in the ocean.

There are three bridges, two railroad and one turnpike, crossing the thoroughfare near Atlantic City, but beyond the limits of the survey.

The thoroughfare is navigated principally by truck boats, varying in size from 18 to 40 feet in length, from 7 to 12 feet in beam, and from 18 inches to 5 feet in draft. The truck season lasts from July 1 to November. During this period about 35 boats, making from 20 to 25 trips each, or 800 trips in all, carrying an average cargo of 5 tons of farm produce, arrive at Atlantic City. Placing the value of the produce at \$10 per ton, the value of this commerce is approximately \$40,000.

Besides the above, there are from 6 to 10 boats of average dimensions, as follows: Length 30 feet, beam 15 feet, and draft 4 to 6 feet, making four trips each from Chincoteague, Va., to Atlantic City. These boats have an average tonnage of 25 tons. They carry potatoes in the early spring and watermelons in August. Calling this commerce 35 trips with 25 tons each, the tonnage is 875, and at \$10 per ton it amounts to \$8,750 annually. On the return trips all these produce boats carry occasional small cargoes of manure, fertilizer, bricks, lumber, etc., but the value of this commerce is insignificant, and is estimated as not exceeding \$5,000.

In addition to the produce, about 350 tons of salt hay are brought from Tuckahoe and Egg Harbor on scows and sloops, its value being about \$6 per ton, or \$2,100 in all.

Oysters and clams are shipped through the thoroughfare from Great Egg Harbor, the yearly value of these being estimated at about \$30,000. This commerce is carried on by small oyster boats, making an average of 350 trips during the spring and fall until ice forms. One gasoline boat has been put in operation in this trade.

In addition to the traffic traversing the entire thoroughfare, a con-

siderable commerce coming through Absecon Inlet uses the part of the waterway adjoining Atlantic City.

The thoroughfare is used largely by pleasure boats, it being estimated that fully 1,000 of these craft, consisting of catboats, small yachts, naphtha launches, etc., and carrying from 3 to 7 persons each, have used the waterway this season. Boats can only cross the shoal between the Point of Marsh and Mikes Island at not less than half tide, and delays of from three to six hours are common. The larger boats can cross only at high water.

Summary.

Articles.	Number of trips.	Tonnage.	Value.
Truck	800	4,000	\$40,000
Truck from Chincoteague.....	35	875	8,750
Salt hay	35	350	2,100
Oysters and clams.....	350	1,500	30,000
Passenger fares.....		375	1,250
Miscellaneous		1,000	5,000
Total value of commerce.....			87,100

The above figures, while they are obtained from the most reliable sources, such as shippers, receivers, vessel captains, etc., are, from the nature of the commerce itself, only approximate. The amount of truck received at Atlantic City varies considerably from season to season, depending on crop conditions and the existing demand, and owing to the manner in which the material is shipped no exact record of its amount can be compiled. The figures given represent, therefore, as nearly as can be determined, the average amount and value of the yearly commerce.

The only obstruction to navigation is the shallow water previously described, and none of the vessels named are able to pass at low tide. The ruling mean low-water depth through the waterway is 6 feet, and in formulating a project this is the depth provided for. In my report dated June 22, 1900, on the preliminary survey of this waterway, it was stated that a channel with a bottom width of 50 feet and a mean low-water depth of 6 feet would be ample for all the commercial purposes of the thoroughfare. On account of the navigation through this waterway consisting principally of sailing vessels, which would be but slightly benefited by a 50-foot channel, and in view of the nature of the bottom and the liability of a narrow channel to deteriorate rapidly, it is now considered advisable to increase the bottom width from 50 to 100 feet, and the project is therefore based on the latter width.

The following plan for improvement is proposed:

The formation of a dredged channel 6 feet deep at mean low water, with a bottom width of 100 feet for a length of about 7,000 feet between the 6-foot contours, together with the widening of the channel at bends, as shown on tracing. It is proposed to deposit the dredged material on the banks of the stream, and the estimate of cost is based on this probable disposition of material.

It is estimated that the proposed improvement will require the removal of 182,000 cubic yards of material, place measurement, at a cost, including contingencies, of \$36,000.

The entire improvement can be profitably executed in one year.

I am of the opinion that this waterway is worthy of improvement by the General Government for the following reasons:

Most of the boats using Beach Thoroughfare come from a long distance and carry perishable cargoes of considerable value. These boats can cross the shoal in this stream at high water only. They frequently run aground, or, missing one high water, are forced to wait until the next, this delay frequently causing the loss of the entire cargo or an arrival in Atlantic City too late for market. The improvement of this waterway would greatly relieve existing commerce and would probably stimulate the navigation of the locality to a marked extent. The cost of the improvement seems moderate in view of the traffic which would be benefited.

Very respectfully, your obedient servant,

C. W. RAYMOND,

Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,

Chief of Engineers, U. S. A.

H 22.

PRELIMINARY EXAMINATION OF MAHON [HARBOR] RIVER, DELAWARE.

[Printed in House Doc. No. 72, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 20, 1900.

SIR: I have the honor to submit herewith for transmission to Congress copy of report dated August 1, 1900, by Gen. William F. Smith, United States agent, major of engineers, United States Army, retired, upon preliminary examination of Mahon (Harbor) River, Delaware, authorized by the emergency river and harbor act approved June 6, 1900.

Very respectfully, your obedient servant,

JOHN M. WILSON,

*Brig. Gen., Chief of Engineers,
U. S. Army.*

Hon. ELIHU ROOT,

Secretary of War.

PRELIMINARY EXAMINATION OF MAHON [HARBOR] RIVER, DELAWARE.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., August 1, 1900.

SIR: I have the honor to report that in compliance with your instructions a preliminary examination of Mahon River, Delaware, has been made under the provisions of the emergency river and harbor act of June 6, 1900, and beg to submit the following report thereon:

The examination was made, under my direction, by Mr. George W. T. Miller, assistant engineer.

Mahon River was examined in 1888 and again in 1894. The report on the latter will be found printed in House Ex. Doc. No. 35, Fifty-third Congress, third session,¹ an extract from which is inclosed herewith. The conditions therein given as to the depth of water over the bar and inside the river were found the same in the present examination, and the washing away of the point on the east side of the mouth of the river has continued.

In my report in 1894 I stated that a jetty would be necessary to preserve a harbor there and that its cost was not warranted by the benefits to be derived therefrom. I adhere to that opinion. There is no commerce on the river.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 2, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

I concur in the opinions of the district engineer.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 25, 1900.

Respectfully submitted to the Secretary of War, concurring in the opinion of the local officer and of the division engineer that improvement of the locality by the General Government, in the manner indicated by the act authorizing the examination, is not advisable.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
October 27, 1900.

The views of the local officer and of the division engineer, as concurred in by the Chief of Engineers, are approved.

ELIHU ROOT,
Secretary of War.

¹Also printed in Annual Report of the Chief of Engineers for 1895, Part II, pages 1149-1151.

REPORT OF MR. A. STIERLE, ASSISTANT ENGINEER.

[Extract from House Ex. Doc. No. 35, Fifty-third Congress, third session.]

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., September 10, 1894.

SIR: In compliance with instructions, I have the honor to submit the following report upon the preliminary examination of Mahon River, Delaware:

A preliminary examination of this river was made in October, 1888, in compliance with the requirements of the river and harbor act of August 11, 1888, and the report is printed in the Annual Report of the Chief of Engineers for 1889, pages 908 and 909. The description of the river given there is here repeated.

"Mahon River is in Kent County, about 34 miles northwest of Cape Henlopen light. It is a sheet of water situated wholly within the low marshy land bordering upon Delaware Bay. The average depth of the river is not over 5 feet at low water and the tide rises $4\frac{1}{2}$ feet. Inside the mouth and for a distance of 2,700 feet the depth is from 10 to 14 feet, and the width between the banks averages 600 feet. This deep pocket is the constituent part of the river from which it derives its importance and reputation as a harbor of refuge for the smaller class of vessels engaged in the dredging of oysters and in trading in this portion of Delaware Bay. The course of the river is nearly parallel with that of the bay shore, the junction with the bay taking place at a very acute angle, opening in a southerly direction. The long promontory thus formed on the east side of the river completely shelters the deep-water portion above referred to, and during rough weather, and particularly during easterly storms, the small harbor is crowded to the utmost by small fishing and oyster schooners and sloops. A narrow bar at the mouth separates deep water in the bay from that in the river."

Since the above report was made the point on the east side of the mouth of the river has been considerably washed away by the incessant action of the waves, and it will not be many years before the narrow strip of marsh left on that side will have disappeared, and then the harbor will be exposed to the full fury of the storms. The depth of water over the bar is now about $5\frac{1}{2}$ feet. There is now considerably less anchorage room than in former years, and many boats in consequence are compelled to anchor outside. Over forty boats and vessels go into the river each night, and the number of boats engaged in the business, as above indicated, is about one hundred, of which about 75 per cent are owned in Philadelphia.

There is no commerce on this river further than a shipping of fish and oysters transferred from the working boats to so-called packets taking the freight to cities.

Besides the making of a channel across the bar, giving a depth of 8 feet at mean low water and having a width of 100 feet, the vessel owners desire that the outer shore should be protected to prevent the washing away of the marsh, and that a breakwater or dike should be built along the east side of the mouth projecting southwardly to about the 8-foot depth in the bay. These works, whether built of stone or wood, would be very costly.

Although the necessity of a harbor of refuge for the vessels using this river as such is apparent, the great cost of improving it is scarcely warranted. The mouths of St. Jones and Murderkill rivers, about 7 miles south of Mahon River, are now being improved by the General Government. It is likely that in the near future the dredged channels made across the flats beyond the shore and extending to deep water in the bay will need solid protection works to prevent their shoaling, and in that case the large area of water inclosed will form a very fine harbor of refuge for these vessels.

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Gen. WM. F. SMITH,
United States Agent.

H 23.

EXAMINATION AND SURVEY OF SMYRNA RIVER, DELAWARE.

[Printed in House Doc. No. 90, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 22, 1900.

SIR: I have the honor to submit the accompanying copies of reports dated August 7 and November 10, 1900, by Gen. William F. Smith, United States agent, major of engineers, United States Army, retired, upon preliminary examination and survey, respectively, of Smyrna River, Delaware, with a view to securing two short crosscuts to shorten the distance from the head of navigation to Delaware Bay, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

In the opinion of General Smith, concurred in by the Division Engineer, Col. Peter C. Hains, Corps of Engineers, the proposed improvement is worthy of being undertaken by the United States, and a project is presented for making the cuts 60 feet wide and 7 feet deep, at an estimated cost of \$15,000.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF SMYRNA RIVER, DELAWARE, WITH A VIEW TO SECURING TWO SHORT CROSSCUTS TO SHORTEN THE DISTANCE FROM HEAD OF NAVIGATION TO DELAWARE BAY.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., August 7, 1900.

SIR: In compliance with Department instructions, I have the honor to report upon a preliminary examination of Smyrna River, Delaware, with a view to securing two short crosscuts to shorten the distance from the head of navigation to Delaware Bay, which examination has been made in conformity with the requirements of the act of June 6, 1900, making provision for emergencies in river and harbor works.

The examination was made under my direction by Mr. George W. T. Miller, assistant engineer, last month. The length of the river is about 9 miles. I inclose a tracing¹ which shows the two cuts I consider most beneficial to shorten the distance between the head of navigation and Delaware Bay, one extending from the turn just below Limekiln wharf to the turn just above Mill Creek, a length of 2,200 feet, and the other from the island below Rothwell's landing to the turn between Deep Hole and Brick Store Landing, a distance of 1,800 feet.

¹ Not printed.

The commerce of Smyrna River was last year reported as 339,791 tons, valued at \$3,769,275. This commerce, in my opinion, justifies the proposed improvement, provided the cost does not exceed \$15,000. I understand that there will be no difficulty in acquiring title to the necessary land.

A survey between Smyrna Landing and Brick Store wharf will be necessary, the cost of which is estimated at \$300. This I recommend.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 10, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

I concur in the opinion of the district engineer that Smyrna River is worthy of improvement by the United States if the expense does not exceed \$15,000, and that a survey should be made at an estimated cost of \$300 if there are funds available for the purpose.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 15, 1900.

Respectfully returned to General Smith with request for statement whether the expense of making the survey recommended within may be paid from the balance unexpended of the appropriation for improvement.

By command of Brigadier General Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE,
Wilmington, Del., August 16, 1900.

Respectfully returned to the Chief of Engineers, United States Army, with report that the unexpended balance of the appropriation for improving Smyrna River can, if desired, be applied to the survey.

WM. F. SMITH,
United States Agent.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 20, 1900.

Respectfully submitted to the Secretary of War.

This report relates to a preliminary examination of Smyrna River, Delaware, with a view to securing two short crosscuts to shorten the distance from the head of navigation to Delaware Bay, made to comply with requirements of emergency river and harbor act of June 6, 1900.

The local and division engineers are of opinion that the proposed improvement is worthy of being undertaken by the General Government provided the cost does not exceed \$15,000.

I recommend that the survey recommended by them be authorized.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT,
August 23, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

SURVEY OF SMYRNA RIVER, DELAWARE, WITH A VIEW TO SECURING TWO
SHORT CROSSCUTS TO SHORTEN DISTANCE FROM HEAD OF NAVIGATION
TO DELAWARE BAY.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., November 10, 1900.

SIR: In compliance with Department instructions of August 27, 1900, I have the honor to report upon a survey which has been made of Smyrna River, Delaware, with a view to securing two short crosscuts to shorten the distance from the head of navigation to Delaware Bay, for which survey provision is made by the emergency act of June 6, 1900. The survey was made last month under my direction by Mr. P. F. Causey, jr., surveyor, under the supervision of Mr. George W. T. Miller, assistant engineer, a copy of whose report is inclosed herewith.

The two crosscuts I consider most beneficial in shortening the distance between the head of navigation and Delaware Bay are those mentioned in my preliminary report, i. e., one extending from the turn just below Limekiln wharf to the turn just above Mill Creek, and the other from the island below Rothwells Landing to the turn between Deep Hole and Brick Store Landing, as shown on the map¹ which is forwarded herewith. The commerce of the river last year was reported to be 339,791 tons, valued at \$3,769,275. This commerce, in my opinion, justifies an expenditure of \$15,000, which I recommend for this improvement; the cuts to be made 60 feet wide and 7 feet deep at mean low water.

¹ Not printed.

It is understood that there will be no difficulty in obtaining title, without charge, to the land required for the crosscuts, and this title will have to be acquired and approved by the proper authorities before work on the improvement is begun.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 12, 1900.

Respectfully submitted to the Chief of Engineers, United States Army, and recommended for approval.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer Southeast Division.

REPORT OF MR. GEORGE W. T. MILLER, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., November 3, 1900.

GENERAL: I have the honor to report upon the survey of Smyrna River, Delaware, made under your direction, "with a view to securing two short crosscuts to shorten the distance from the head of navigation to Delaware Bay." The survey was made in the early part of last month, October, and extended from the bridge at Smyrna Landing to Brick Store wharf, a distance of 15,800 feet, measured along the stream. It included the hydrography of the river and the topography of the shores far enough back from the river to include the location of the suggested cut-offs.

The accurate determination of the topography of the land adjacent to the river was the principal object of the present survey, in order to so locate the cut-offs that they would avoid any high land and be entirely through marsh. The maps of former surveys gave the line of the river accurately enough to determine the approximate location of the cut-offs, and this location, as shown upon the tracing accompanying the report on the preliminary examination, has been adhered to with the exception of the slight bend in the line of the upper cut-off, made to avoid the tongue of fast land near by.

The report upon the preliminary examination designated the location of the two cut-offs that were considered most beneficial in shortening the distance between the head of navigation and Delaware Bay, and it is but necessary in this report to give the estimated cost of making them.

The upper one begins at a point 3,600 feet below the wharves at Smyrna Landing and cuts across the marsh, crossing the line of the river once to the turn just above Mill Creek, where a cut-off was made years ago by private parties; the former bend is shown upon the map. From high-water line to high-water line this cut-off is 2,215 feet long, and including approaches 2,455 feet long; it cuts off a bend 3,400 feet long, which includes three sharp turns and two shoals, which are difficult to maintain at the depth required by the project for the improvement of the river. It will require the removal of 59,760 cubic yards of material, place measurement, to make this cut 60 feet wide and 7 feet deep at mean low water.

The second cut-off begins just below Rothwells Landing, and runs in a perfectly straight line to the turn above Brick Store wharf, cutting off the bend known as Deep Hole Reach, 3,750 feet long, in which are two shoals which have re-formed after repeated dredging. This cut-off from high-water line to high-water line is 1,720 feet long, and including approaches 2,200 feet long. To make it of the same dimensions as the first will require the removal of 44,400 cubic yards of material, place measure.

The total excavation for the two cut-offs will therefore be 104,160 cubic yards. At 15 cents per cubic yard, including contingencies, this will amount to \$15,624, but it is quite probable that the work can be done within the money limit set in the preliminary report, \$15,000, as the prices for dredging prevailing of late would bring the cost of the work well within that limit.

Those interested in the improvement of the river say that there will be no difficulty in securing the land through which the cut-offs pass, and as it is marsh land, practically worthless, ample width should be secured for the right of way in the event of future widening and for the deposit of material dredged from the cuts.

If it is found that the adjacent marsh will not support the banks of dredged material, it can be disposed of in the bends cut off, where it can be placed at their upper ends, thus assisting in forcing the water through the cut-offs.

For additional information regarding the river, I respectfully refer to the reports upon the preliminary examination.

Very respectfully, your obedient servant,

GEORGE W. T. MILLER,
Assistant Engineer.

Gen. WM. F. SMITH,
United States Agent, Wilmington, Del.

H 24.

EXAMINATION AND SURVEY OF MISPELLION RIVER, DELAWARE.

[Printed in House Doc. No. 102, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 22, 1900.

SIR: I have the honor to submit herewith copies of reports, dated June 19 and October 18, 1900, by Gen. William F. Smith, United States agent, major of engineers, U. S. A., retired, upon preliminary examination and survey, respectively, of Mispillion River, Delaware, from its mouth to the head of navigation, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

This river has been under improvement by the General Government since 1879, and, in the opinion of General Smith and the division engineer, Col. Peter C. Hains, Corps of Engineers, is worthy of further improvement by dredging, jetty construction, etc., as indicated, all at an estimated cost of \$87,065, which includes contingencies.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF MISPELLION RIVER, DELAWARE, FROM ITS MOUTH TO THE HEAD OF NAVIGATION.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., June 19, 1900.

GENERAL: Referring to department letter of the 13th instant, I have the honor to state that the data in this office enable me to report upon

Mispillion River, Delaware, a preliminary examination of which is provided for in the act making provision for emergencies in river and harbor improvements approved June 6, 1900, and I therefore report upon it as follows:

The Mispillion River forms part of the boundary between Kent and Sussex counties, and is a narrow and tortuous stream about 18 miles long, flowing into Delaware Bay about 17 miles northwest of Cape Henlopen.

It has been under improvement since 1879, on a project for a channel 6 feet deep at mean low water, and 40 feet wide from Milford to the mouth. With the exception of a small shoal near the mouth, which required removal to the projected depth, the project had been nearly completed in 1890, and the total amount expended up to that year was \$17,000.

A preliminary examination of the obstructions at the mouth was ordered by the river and harbor act of September 19, 1890, and was followed by a survey made in 1891. A project was submitted for their removal by dredging a cut 150 feet wide and 6 feet deep at mean low water across the mud flats, at an estimated cost of \$24,000.

This was adopted in 1892, when the first appropriation for it was made. Actual operations were carried on in 1893, 1895, 1897, and 1899. In the first-named year the project was modified to include, in addition, a pile dike on the north side of the mouth about 500 feet long; in 1895 a further modification was authorized for the construction of a crib dike 350 feet long from the shore along the south side of the proposed cut, the necessity for both dikes to protect the cut and to concentrate the currents having appeared during the progress of dredging operations, the material removed consisting principally of treacherous "live" sand. In 1897 the pile dike was lengthened by 200 feet by a brush and stone extension, and in 1899 a single pile jetty was built for a length of 141 feet, extending from the inner end of the brush and pile jetty northward to the high-water line of the Mispillion River, and a similar jetty was built from Green Point due east for a length of 206 feet.

In 1893 a channel 80 feet wide and 5 feet deep was dredged for a length of 570 feet from the 5-foot depth in the Mispillion River to a point 50 feet west from the outer end of the dike. In 1895 a channel 75 feet wide and 6 feet deep was dredged from inside the river just above Sandy Point to opposite the mouth of Cedar Creek, and in 1897 a cut 50 feet wide and 6 feet deep at mean low water was made for a length of 450 feet from near the end of the crib dike, but this cut shoaled to 4 feet during severe storms shortly thereafter, and a cut of that depth and 40 feet wide was then made across the Bulkhead shoal, resulting in a continuous channel 4 feet deep at mean low water and 40 feet wide from inside the river to and across the Bulkhead shoal outside. An examination made early in April, 1899, showed that the 4-foot depth at the mouth dredged in 1897 had not changed much, but that the cut across the Bulkhead shoal had filled in considerably.

In addition to the foregoing, a cut was excavated in 1898, by private parties interested in the navigation of the river, in a southeasterly direction across the flats from the south end of the jetty to the 2-foot curve in Delaware Bay.

In 1878 the shipping of Milford consisted of seven schooners of

from 75 to 150 tons burden. The exports and imports amounted to 28,693 tons, valued at \$262,000. Commercial statistics furnished for the past calendar year show that the imports and exports amounted to 103,432 tons, valued at \$1,902,840.

I am of opinion that the present and prospective demands of the commerce of this river warrant its improvement by the General Government.

No accurate instrumental survey of this river has ever been made except at the mouth, the original estimates and projects for the improvement inside the river having been based upon a rough reconnaissance made with the aid of a county map. The distance between the mouth and the head of navigation, at Milford, is about 18 miles. To survey this total length and to make further hydrographic examinations of the mouth will cost \$1,000. The sum of \$950 is now available from previous appropriations for the improvement of the river, which, under the terms of the act of June 6, 1900, can be applied to this survey, which I recommend.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., June 20, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

The Mispillion River is a small stream, but the large increase in the value of its commerce—from \$262,000 in 1878 to \$1,902,840 in 1899—shows that it is worthy of improvement.

I concur in the views of the district engineer, and recommend that the survey be made.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 25, 1900.

Respectfully submitted to the Secretary of War.

Under the provisions of the emergency river and harbor act approved June 6, 1900, a preliminary examination has been made of Mispillion River, Delaware, from its mouth to the head of navigation.

The stream is reported to be worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
June 26, 1900.

Approved as recommended by the Chief of Engineers.

By order of the Acting Secretary of War:

J. B. RANDOLPH,
*Acting Chief Clerk.*SURVEY OF MISPELLION RIVER, DELAWARE, FROM ITS MOUTH TO THE
HEAD OF NAVIGATION.UNITED STATES ENGINEER OFFICE,
Wilmington, Del., October 18, 1900.

GENERAL: I have the honor to report, in compliance with Department instructions of June 27, 1900, upon the survey of the Mispillion River, Delaware, from its mouth to the head of navigation, for which provision is made by the emergency river and harbor act of June 6, 1900. The survey was made in July last under my direction by Mr. P. F. Causey, jr., surveyor, under the immediate supervision of Mr. G. W. T. Miller, assistant engineer, a copy of whose report thereon is inclosed herewith.

The Mispillion River has been under improvement by the General Government since 1879. Between that year and 1889 the river from Milford to the mouth was improved, and \$17,000 expended in making a channel 40 feet wide and 6 feet deep at mean low water. No work was done at the mouth. In 1882 Capt. Wm. Ludlow, Corps of Engineers, in a report on a preliminary examination of the mouth, under the provisions of the river and harbor act of March 3, 1881, submitted a project which included a jetty on the north side, but no action was taken upon it.

In 1891 a survey of the mouth was made under the provisions of the river and harbor act of September 19, 1890, "with a view to cutting a canal to shorten the distance to the bay and making an outlet in the bay which would furnish deeper water." Several plans which included jetties on the north and south sides of the channel were considered, the cost of them ranging between \$65,000 and \$190,000, and the conclusion reached was that the commerce at that time did not warrant so large an expenditure, and a plan was adopted for dredging a cut across the flats in a southeasterly direction, the width to be 150 feet and the depth 6 feet at mean low water, the cut to be protected on the upper or north side by a bank made of the dredged material, at an estimated cost of \$24,000. In this project it was assumed, as it had been by Captain Ludlow, that the conditions existing at the mouths of other streams emptying into Delaware Bay could be safely taken as a basis for this project. The experience obtained since, however, has shown this assumption to be incorrect, owing to the currents and the rapid movements of quicksands during the fierce storms which prevail at this place. These have made attempts to permanently improve the mouth a failure until last year, when the small balance available was applied to the construction of 200 linear feet of jetty on the south side.

The recent survey has given important data, and the project herewith submitted is the result. It will be necessary to guide the united

currents of Cedar Creek and the Mispillion during the ebb of the tide over the flats out toward the deep water of the Delaware by a jetty on the south side extending to the 4-foot curve in the bay. The location of this jetty is shown on the accompanying map¹ and extends from the end of the present Green Point jetty to the inner end of the dredged bank made in 1898, about 300 feet, and then following parallel to the dredged cut, to the 4-foot curve, about 4,700 feet. A description of this jetty is given on the map.

The Mispillion River has important shipbuilding interests, and the commerce reported for the year 1899 was 103,432 tons, valued at \$1,902,480. This commerce, in my judgment, justifies the improvements herein recommended, which are as follows:

Dredging channel 6 feet deep at mean low water and 60 feet wide, widening to 75 feet at sharp turns, from Milford to the mouth, 200,000 cubic yards, at 15 cents	\$30,000
Dredging a channel 4 feet deep at mean low water and 150 feet wide across the flats at the mouth to the 4-foot curve in Delaware Bay, 70,000 cubic yards, at 15 cents	10,500
For construction of a jetty at the mouth on the south side, 5,000 linear feet, at \$7.50 per foot	37,500
For nest of piles at end of jetty	100
Removing unserviceable crib work	1,050
	79,150
Engineering and contingent expenses, 10 per cent	7,915
Total	87,065

This estimate is rather large, but the unusual conditions at this place make protective works, which largely increase the cost, indispensable to the maintenance of the channel.

I beg to add that no part of the work to be done at the mouth can be made available for navigation until the whole has been completed. For this reason and on account of the severity of the storms there, which would endanger, if not destroy, any partial work, the entire work should be done at one time. The crib work now at the mouth, which is in bad condition, should be removed in any event without delay.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., October 20, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

I concur in the opinion expressed by the district engineer that the south side is the proper one on which to build a jetty, but I have some misgivings as to the efficiency of a single jetty in keeping open a dredged channel.

In northeasters the sand would, I should suppose, be washed into the

¹ Not printed.

channel and choke it up. It is possible, however, that this may not occur. If it does, the remedy will be more dredging or the building of a north jetty.

In view of the possibility of getting along with a single jetty, the project is recommended for approval.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

REPORT OF MR. GEORGE W. T. MILLER, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., October 17, 1900.

GENERAL: I have the honor to report upon the survey of Mispillion River, Delaware, from the mouth to the head of navigation.

The survey was made during July last, and extended from Walnut Street Bridge, Milford, to the 6-foot curve of Delaware Bay, in a southeasterly direction from the mouth of the river, a total distance of 76,000 feet, or 14.4 miles, measured along the river channel.

The survey embraced the hydrography of the river, the topography of the shores far enough back from the stream to determine the character of the land at the bends where cut-off canals might be projected, the tidal data of the river observed from three stations, and current observations both by float and meter. The current observations were made to supplement observations made at various times since 1893.

Three tidal stations were established and referred to permanent bench marks near by, and staff readings were taken and recorded at all three during the survey, a period of twenty-five days.

The first station was at the light-house at the mouth of the river, the second at New Wharf, 8.6 miles up the river and the first place above the mouth where a tide board could be placed, and the third at Simpson's phosphate factory, 3.8 miles farther upstream and near the head of navigation. The weather was unusually warm and dry during the progress of the survey, and there were no storms to disturb the regularity of the tide.

The mean range of tide (rise and fall) at the mouth was found to be 4.35 feet and at New Wharf and Simpson's 3.4 feet. According to the levels taken between the tide gauges the low-water mean is on a level at the latter two places, while at the mouth it is a half foot lower.

The steamboat landing about 2,000 feet above Simpson's is as far up as navigation goes. At this point the stream widens and serves as a turning basin. Above there it becomes very narrow and shallow, although the tidal influence extends to about a half mile above the Walnut Street Bridge.

The history of the improvement since 1879, when the General Government took hold of the Mispillion River, is given in the preliminary report of June 19, 1900, to which I respectfully refer.

The present survey is the first instrumental survey of the river made by the Government. One was made of the mouth in 1891. The distance from the head of navigation to the mouth has heretofore been counted 18 miles, but the recent survey accurately measures the distance between the same points as 13.1 miles.

From the head of navigation downstream the river for the first 5 miles, or to a little below New Wharf, is very narrow and flows through slightly rolling country, either wooded or cultivated, the land immediately bordering the stream being marshy in most places and covered by thick cripple and brush; the remaining distance to the mouth is through low level salt marshes, clear of all growth but salt grass. This marsh is but little above ordinary high tide, and storm tides inundate it for miles back into the country. The river throughout this stretch is much wider and deeper, and the channel dredged under the project of 1879 has proved quite permanent, very little dredging being required to reestablish a 6-foot navigation up as far as New Wharf. From New Wharf to the steamboat landing the channel has deteriorated greatly, and within this section it is earnestly desired by those interested in the improvement that three cut-offs be made to eliminate some very sharp bends difficult to navigate, as well as to shorten the distance from Milford to the mouth.

The waters of the Mispillion carry very little sediment and are usually quite clear, and it appears that the deterioration of the channel in the upper and narrow reaches

is due almost entirely to the suction of the steamboat, which fills nearly the whole cross section of the stream.

Until 1897 the commerce of the river was carried on exclusively by sailing vessels of small tonnage, which the 40-foot channel, made under the project of 1879, fully accommodated. Quite a number of larger vessels, running as high as 1,200 tons, have been built at Milford, but they were never intended to trade in the river, and their maiden trip down the tortuous and narrow channel was usually their last appearance in the river. In 1897, however, a steamboat line between Milford and Philadelphia was established and with some interruptions has continued till the present time.

The first steamboat used was 136 feet long and 23 feet beam, while the one at present running is 114 feet long by 21 feet beam. It is really astonishing how these boats have made some of the sharp turns in the upper river. The first boat, though of greater dimensions, had the advantage of twin screws, but both of them had to be used with the greatest care in rounding the turns. The restoration of the former project depth, 6 feet at mean low water, with a width of 60 feet, would seem to meet the requirements here. A further improvement would be the making of several cut-offs in the upper river. Three of them would shorten the distance by 6,600 feet.

As to the mouth, a survey was provided for in the act of March 3, 1881, and upon its completion a project was submitted for the improvement which called for dredging a channel across the flats and protecting it from the littoral drift of sand by a jetty on the north side. This project was not, however, carried out.

Like all the other tributaries of the Delaware Bay, the Mispillion is blockaded at its mouth by a wide expanse of flat foreshore running out a mile or more and barely covered at low water. It was assumed that conditions here were practically the same as at the other streams, where the cuts made through the flats were found to be reasonably stable, but the attempts to make a cut here have shown the conditions to be entirely different. In all the calculations Cedar Creek has been omitted as an unimportant factor; but observations for the last seven years show that the volume of water coming from Cedar Creek on the ebb enters very materially into the problem of making an outlet across the flats at the mouth of the Mispillion, where the two streams unite.

One of the important difficulties in making and maintaining a channel at the mouth is occasioned by the littoral drifts. These have closed the outlets of several of the streams formerly flowing into Delaware Bay between the Mispillion and Cape Henlopen. Prime Hook Creek, once deep and wide, is now a stagnant pool, and Slaughter Creek and Cedar Creek were likewise cut off. By the enterprise of the people in the vicinity of Cedar Creek a new mouth was made for that stream by cutting a canal about 25 feet wide and 5 feet deep at low water for a distance of 2 miles, so that its waters would discharge into the bay at the point where the Mispillion empties. The creek is narrow, but very long, and drains an extensive area. After heavy rains it has been observed that it will run for days in a downstream direction, the flood tide of the bay not being able to overcome the volume of water coming from it. Ordinarily its volume on the ebb is not as great as that of the Mispillion, and the resultant of the junction of these two currents has made a channel about 1.5 to 2 feet deep at low water. This channel flows close inshore and follows the shore line for about half a mile southward, where it turns sharply at right angles into a depression in the flats of equal depth and then to the channel of Delaware Bay. This roundabout way is the one that has always been used by vessels entering and leaving the Mispillion and Cedar Creek.

The projects heretofore laid particular stress upon protection for the channel across the flats in the form of a jetty on the north side, with possibly one on the south side as an adjunct, but not absolutely indispensable. It now seems, from the experience of the last seven years, that the reverse is the proper arrangement of the jetties.

A jetty on the north side is very important to keep the littoral drift of sand and that driven by storms from the north and northeast from filling up and obliterating any cut that may be made across the flats, but it would have absolutely no effect upon the currents of the two streams, which, after uniting, would be left to spread out to the southward fan shape and be lost in the neutral area of the flats.

It would seem, in the light of the current observations recently taken, both for direction and strength of the ebb, and from a close study of the conditions prevailing there, that a jetty on the south side, so located as to direct the waters of both the Mispillion River and Cedar Creek into a common and contracted channel across the flats, would be sufficient to maintain such a channel, unless a sudden and heavy storm from the northward should overwhelm the usual forces and dam up the cut beyond the power of the streams to cut through. In such a case a jetty, or more properly, a sand fence, on the north side would come into play. Any construction,

both for the north and the south sides, must be water-tight and sufficiently strong to withstand the severe storms which frequently visit this locality and the fields of ice which accumulate upon the flats in winter.

In the spring of 1898 the steamboat people made a cut 60 feet wide and about 3 feet deep, southeast from the mouth of the river, across the flats, to the 2-foot contour of the bay, throwing the dredged material to the southward. This bank of material formed a jetty while it lasted and guided a portion of the ebb from the Mispillion through the cut, keeping it scoured out, while the remainder of the ebb from the Mispillion and Cedar Creek followed the channel before mentioned down shore.

All observations bear out the idea that a jetty from the shore out to the outer end of a cut across the flats on the south side and so located as to train the waters of both the Mispillion River and Cedar Creek into a common channel would be entirely effective in maintaining a channel once dredged. On the ebb tide the sand composing the bottom at the mouths of the streams is a boiling mass and shifts with every tide. The current meter observations gave velocities of from 0.5 foot to 4 feet per second, the former at the first and last stages of the tide and the latter at its maximum, where the waters of Mispillion River and Cedar Creek come together. The lower velocity is sufficient to move sand, while the maximum is capable of moving shingle 1 inch in diameter.

In September, 1899, working along the line of a south-side jetty, 200 feet of jetty was built on the south side out from the shore; but as there were no funds available to dredge out the cut across the flats the jetty could not be extended to meet the dredged bank, as it would thereby close the channel along the shore, the only entrance to the streams. Incomplete as it was, it has shown its effect and confirms the idea that if extended it will be successful. The only uncertain element as to the sufficiency of the south jetty alone is the possibility of a heavy rush of sand driven before a northerly storm banking up against the jetty and choking the cut so quickly that the currents will not have time to come into play. A remedy for this, already recommended in previous reports, is a north-side jetty high enough to keep the sand out. Five hundred feet of such a barrier was built on Sand Point in 1893, and an extension of it is warranted by the results obtained from it. There can be no doubt about the necessity of substantial protective works in maintaining any channel that may be dredged across the flats.

I submit for your consideration two forms of jetty which are strong and inexpensive: First, a line of piles, 3 feet centers, with tops cut off about 1 to 2 feet above high water; wales at top and near low-water line; sheathing on the channel side driven well down; back of this row, about 10 feet, another row of heavy piles spaced 9 feet centers; tops to be 8 to 10 feet above low water to act as ice breakers and attached to the first row of piling by tie-rods and braces. This construction, I think, would be well adapted for the south side, and behind it should be banked the material dredged from the cut. This jetty can be built for \$5 per linear foot.

The second form, well adapted for both sides, is similar in the main to the existing jetty on Sand Point. Two rows of piles 6 feet apart, center to center, and piles in each row spaced 2 feet, center to center, fastened with wales and cross-ties; the space between the two rows to be filled with compacted brush, upon which 2 feet of rip-rap stone. This can be built for \$7.50 per linear foot. A part of the present crib work must be removed, the cost of which is estimated to be \$1,050. I also submit an estimate of cost of dredging, as follows:

Dredging channel from Milford to the mouth, 6 feet deep at mean low water and 60 feet wide, at sharp turns 75 feet wide, 200,000 cubic yards, at 15 cents	\$30,000
Dredging a channel 4 feet deep at mean low water and 150 feet wide at the mouth, to the 4-foot depth in Delaware Bay, 70,000 cubic yards, at 15 cents	10,500
	40,500
Add 10 per cent for engineering and contingent expenses	4,050
Total	44,550

Very respectfully, your obedient servant,

GEO. W. T. MILLER,
Assistant Engineer.

Gen. WM. F. SMITH,
United States Agent.

APPENDIX I.

IMPROVEMENT OF RIVERS AND HARBORS IN MARYLAND TRIBUTARY TO CHESAPEAKE BAY, AND OF BROAD CREEK AND NANTICOKE RIVERS, DELAWARE AND MARYLAND.

*REPORT OF LIEUT. COL. O. H. ERNST, CORPS OF ENGINEERS, OFFICER
IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH
OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

- | | |
|---|---|
| 1. Susquehanna River above and below
Havre de Grace, Md. | 8. La Trappe River, Maryland. |
| 2. Patapsco River and channel to Balti-
more, Md. | 9. Warwick River, Maryland. |
| 3. Channel to Curtis Bay, in Patapsco
River, Baltimore Harbor, Maryland. | 10. Nanticoke River, Delaware and Mary-
land. |
| 4. Harbor of Southwest Baltimore (Spring
Garden), Maryland. | 11. Broad Creek River, Delaware. |
| 5. Queenstown Harbor, Maryland. | 12. Wicomico River, Maryland. |
| 6. Chester River, Maryland, from Crump-
ton to Jones Landing. | 13. Manokin River, Maryland. |
| 7. Choptank River, Maryland. | 14. Pocomoke River, Maryland. |
| | 15. Removing sunken vessels or craft
obstructing or endangering naviga-
tion. |

EXAMINATION AND SURVEYS.

- | | |
|---|--|
| 16. Harbor of Havre de Grace, Maryland. | 17. Channel in Curtis Bay, Baltimore,
Maryland. |
|---|--|

HARBOR LINES.

18. Annapolis Harbor, Maryland.
-

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., July 27, 1901.

GENERAL: I have the honor to forward herewith the annual reports for the year ending June 30, 1901, for the works of improvement of rivers and harbors in my charge.

Very respectfully, your obedient servant,

O. H. ERNST,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

I 1.

IMPROVEMENT OF SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE
DE GRACE, MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

See page 218, Annual Report of the Chief of Engineers 1900 for full history.

No work has been done since 1899.

Money statement.

July 1, 1900, balance unexpended	\$9,734.05
July 1, 1901, balance unexpended	9,734.05
{ Amount (estimated) required for completion of existing project	94,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—	
August 30, 1852	\$10,000
June 23, 1866	26,400
July 25, 1868 (allotment)	5,000
April 10, 1869 (allotment)	990
July 11, 1870	12,000
June 14, 1880	28,000
March 3, 1881	15,000
	\$97,390
By act passed August 2, 1882	25,000
By act approved—	
July 5, 1884	20,000
August 5, 1886	6,000
By act of August 11, 1888	10,000
By act approved—	
September 19, 1890	4,000
July 13, 1892	4,000
1879, allotment from general appropriation for examinations and surveys	500
By act of August 18, 1894	4,000
	73,500
Aggregate	
	170,890

COMMERCIAL STATISTICS.

It was impracticable to obtain complete commercial statistics. It is in the collection district of Baltimore (see statistics for that port), which is the nearest port of entry.

I 2.

IMPROVEMENT OF PATAPSCO RIVER AND CHANNEL TO BALTIMORE,
MARYLAND.

Dredging was in progress under the continuing contract during the whole fiscal year, with an intermission from February 1 to March 12, when operations were suspended on account of ice and rough water.

The dredge of the largest capacity, the *Admiral*, was destroyed by fire November 12, but was replaced December 1 by the *Baltic*, of less output, which in turn was partially burned January 4 and undergoing repair until April 1. With the intermissions mentioned, four dredges, three of the "clam-shell" and one of the "endless-bucket" or elevator type, were engaged on the contract, the latter working entirely on the parts of the channel having a hard bottom, to which it is best adapted of any composing the plant. Notwithstanding the delays due to the elements and accidents, the contractor has exceeded the requirements of the contract as to rate of progress by 2,028,275 cubic yards of material. The quantity of material removed during the fiscal year is 4,068,502 cubic yards, and the whole amount under the contract 6,028,275 cubic yards. It is proposed to complete the contract and the project with the funds available.

The estimate for the improvement of Patapsco River and channel to Baltimore, Md., submitted in 1894, was \$2,500,000, and was for increasing the bottom width of the channel, which was then 600 feet, to 1,000 feet, retaining the depth then existing of 27 feet. Under the authority contained in the river and harbor act of June 3, 1896, the proposed depth of the channel was increased to 30 feet. The law was silent as to the width, but in the project under it, approved by the Secretary of War July 10, 1896, under which improvement has since been progressing, the old width (600 feet) was retained. The original estimate was retained, and the money statements which have appeared in the annual reports, including the last report, have been deduced therefrom. The excavation has cost less per cubic yard than was estimated. The project of July 10, 1896—that is, a channel 30 feet deep and 600 feet wide—will be completed under the present continuing contract, and with an expenditure of \$1,100,000 less than the estimate. Either the money statement or the project should be modified.

A channel 600 feet wide and 30 feet deep will not answer the future needs of this port, but the saving of \$1,100,000 on the estimate is not sufficient to excavate an adequate channel. An approximate estimate for increasing the depth to 35 feet, retaining the present bottom width, was printed in Senate Doc. No. 118, Fifty-sixth Congress, second session, and amounted to \$5,300,000. It would seem that nothing should be done toward such a project without the specific authority of law. The money statement attached to the annual report has therefore been modified by omitting the balance of \$1,100,000 as remaining to be appropriated.

See Annual Report of the Chief of Engineers for 1900, pages 231–232, for detailed history of the improvement.

Money statement.

July 1, 1900, balance unexpended	\$432, 666. 29
Amount appropriated by sundry civil act approved March 3, 1901	475, 352. 00
June 30, 1901, amount expended during fiscal year	908, 018. 29
	341, 749. 53
July 1, 1901, balance unexpended	566, 268. 76
July 1, 1901, outstanding liabilities	2, 000. 00
July 1, 1901, balance available	564, 268. 76
July 1, 1901, amount covered by uncompleted contracts	564, 268. 76

The following are the amounts and dates of appropriations for improving harbor at Baltimore, Md., including Patapsco River:

August 30, 1852	\$20,000	March 3, 1881	\$150,000
August 15, 1856	100,000	August 2, 1882	450,000
June 28, 1864	20,000	July 5, 1884	250,000
June 23, 1866	5,200	August 5, 1886	150,000
March 3, 1867	75,000	August 11, 1888	300,000
July 25, 1868	17,000	September 19, 1890	340,000
April 10, 1869	26,730	March 3, 1891	151,200
July 11, 1870	42,900	August 5, 1892	208,000
March 3, 1871	50,000	August 18, 1894	50,000
June 10, 1872	100,000	June 3, 1896	400,000
March 3, 1873	200,000	June 3, 1896	50,000
June 23, 1874	75,000	March 3, 1899	200,000
March 3, 1875	75,000	June 6, 1900	324,648
August 14, 1876	75,000	March 3, 1901	475,352
June 18, 1878	75,000		
March 3, 1879	160,000	Total	4,716,030
June 14, 1880	100,000		

CONTRACT IN FORCE.

Continuous contract with Simon Hess, at $8\frac{33}{100}$ cents per cubic yard, approved July 5, 1899, commenced September 12, 1899, and expires June 30, 1903.

COMMERCIAL STATISTICS.

OFFICE OF THE COLLECTOR OF CUSTOMS, PORT OF BALTIMORE, MD., July 15, 1901.

SIR: I have pleasure in handing you herewith a statement of commercial statistics as disclosed from the records of this office for the fiscal year ended June 30, 1901.

Respectfully,

WM. F. STONE,
Collector.

Col. OSWALD H. ERNST, U. S. A.,
Engineer in charge of the Improvement
of Patapsco and Baltimore Harbor.

Commercial statistics of the port of Baltimore, Md., comparing the fiscal years ended June 30, 1900 and 1901.

Imports.	Free.	Dutiable.	Total.
1900	\$12,026,474	\$7,016,507	\$19,042,981
1901	11,589,805	7,309,668	18,899,473
Decrease, 1901	436,669		143,508
Increase, 1901		293,161	

IMPORTS.

In American vessels in 1901:	
Sailing	\$2,235,214
Steam	690,216
In foreign vessels in 1901:	
Sailing	104,841
Steam	15,838,000
In cars overland	31,202
Total	18,899,473

Commercial statistics of the port of Baltimore, Md., etc.—Continued.

DOMESTIC EXPORTS.

1900.....	\$115, 432, 167
1901.....	106, 161, 392

Decrease in 1901.....	9, 270, 775
-----------------------	-------------

In American vessels in 1901:

Sailing.....	1, 089, 312
Steam.....	18, 212

In foreign vessels in 1901:

Sailing.....	58, 242
Steam.....	104, 995, 626

RECAPITULATION.

In American vessels in 1901.....	\$1, 107, 524
In foreign vessels in 1901.....	105, 053, 868
Total exports in 1901.....	106, 161, 392

PRINCIPAL ARTICLES EXPORTED.

	Tons.		Tons.
Cattle.....	40, 185	Beef products.....	10, 820
Grain.....	1, 259, 201	Pork products.....	21, 640
Flour.....	271, 108	Lard.....	43, 947
Coal.....	527, 227	Oleomargarine.....	20, 330
Copper.....	29, 203	Starch.....	8, 848
Cotton, manufactures.....	35, 086	Rosin.....	52, 454
Glucose.....	9, 101	Tobacco.....	33, 379
Iron and steel.....	158, 333	Oils.....	155, 656
Oil cake.....	47, 693	Wood, and manufactures of.....	236, 231

Amount of duties collected in 1901.....	\$2, 909, 134. 91
Miscellaneous customs receipts in 1901.....	111, 519. 01

Total receipts in 1901.....	3, 020, 653. 92
Total receipts in 1900.....	2, 849, 565. 53

Increase in 1901.....	171, 088. 39
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Duties on merchandise in bond in 1900.....	176, 971. 35
Duties on merchandise in bond in 1901.....	216, 670. 10

Increase in 1901.....	39, 698. 75
-----------------------	-------------

SUMMARY OF DUTIES COLLECTED IN 1901.

Imports and miscellaneous customs receipts.....	\$3, 020, 653. 92
Merchandise in bond.....	216, 670. 10
Merchandise transported with appraisement.....	13, 921. 05
Total.....	3, 251, 245. 07

STATISTICAL RECAPITULATION.

Dutiable imports have increased.....	\$293, 161. 00
Free imports have decreased.....	\$436, 669. 00
Domestic exports have decreased.....	\$9, 270, 775. 00
Tonnage (foreign) has decreased..... tons.....	46, 872
Duties collected have increased.....	\$187, 095. 40
Duties on merchandise in bond have increased.....	\$39, 698. 75
Duties on merchandise in bond with and without appraisement have decreased.....	\$4, 720. 89

Commercial statistics of the port of Baltimore, Md., etc.—Continued.

TONNAGE MOVEMENT.

	1900.		1901.	
	<i>Number.</i>	<i>Tonnage.</i>	<i>Number.</i>	<i>Tonnage.</i>
Foreign trade:				
Entered.....	911	1,677,383	880	1,647,207
Cleared.....	925	1,775,269	922	1,758,573
Coasting trade:				
Entered.....	1,544	2,022,848	1,522	2,075,838
Cleared.....	2,257	2,466,080	2,209	2,573,399

IMMIGRANT PASSENGERS.

	Male.	Female.	Total.
1899-1900.....	29,817	6,749	27,566
1900-1901.....	13,323	3,993	17,316

VESSELS BUILT 1900-1901.

	Number.	Gross tons.	Net tons.	Value.
Steam.....	20	10,703	7,789	\$1,463,800
Sail.....	25	1,413	1,224	80,750
Barges (documented).....	23	5,712	4,960	223,800
Total.....	68	17,828	13,973	1,768,350

STEAMSHIP LINES.

	Number.	Tonnage.	
Atlantic Transport Company.....	9	25,158	London.
Lord Line.....	13	31,725	Belfast and Dublin.
Empire Line.....	7	12,913	Leith.
Hamburg-American.....	24	93,863	Hamburg.
United Fruit Company.....	10	7,320	Cuban and Jamaican ports.
Di Giorgio Importing and Steamship Company.	2	1,021	Jamaica.
Neptune Line.....	8	17,089	Rotterdam.
Earn Line.....	7	10,961	Cuban and Mediterranean ports.
Johnston Line.....	5	22,793	Liverpool.
Blue Cross Line.....	1	2,979	Havre.
Donaldson Line.....	7	20,649	Glasgow.
Puritan Line.....	4	9,060	Antwerp.

The following lines have added to the number of vessels:

Atlantic Transport Line to London.....	2
Lord Line to Belfast and Dublin.....	1
Empire Line to Leith.....	3

The following lines have reduced the number of vessels:

Hamburg-American Line to Hamburg.....	1
Neptune Line to Rotterdam.....	1
Earn Line to Cuban and Mediterranean ports.....	3

The Buckman Line to Cuban and Jamaican ports is succeeded by the United Fruit Company's line, and the West India Fruit Company by the Di Giorgio Importing and Steamship Company.

The foreign tonnage movement at this port shows a falling off of $1\frac{1}{2}$ per cent as compared with the close of the last fiscal year. Whether or not this slight loss is due to certain alleged railroad discriminations I will not venture to say. The coastwise trade shows an increase. Our shipbuilding interest is still in a flourishing condition. All of our yards are full up with orders. There were built and documented

in this district during the year 68 steam and sail vessels, having an aggregate gross tonnage of 13,973 tons and valued at \$1,768,350.

At the yards of the Maryland Steel Company, aside from the three torpedo-boat destroyers and the mammoth steel floating dry dock for the United States Navy, four 11,000-ton steel steamships are on the ways.

There are now thirteen established lines of steamships trading at this port, representing 106 vessels, with an aggregate net tonnage of 288,300 tons and an estimated carrying capacity of 432,450 tons of cargo.

I 3.

IMPROVEMENT OF CHANNEL TO CURTIS BAY, IN PATAPSCO RIVER, BALTIMORE HARBOR, MARYLAND.

There were no operations during the fiscal year owing to the exhaustion of funds. An estimate of the cost of deepening and widening the channel is printed in Senate Doc. No. 118, Fifty-sixth Congress, second session.

Money statement.

July 1, 1900, balance unexpended	\$138. 07
June 30, 1901, amount expended during fiscal year	138. 07
{ Amount (estimated) required for completion of existing project	45,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	45,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The following are the amounts and dates of appropriations for improving channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.

July 13, 1892.....	\$28,000. 00
August 18, 1894	12,000. 00
Total	40,000. 00

This work is in the collection district of Baltimore.

I 4.

IMPROVEMENT OF HARBOR OF SOUTHWEST BALTIMORE (SPRING GARDEN), MARYLAND.

Nothing has ever been done, the appropriation being too small to justify the commencement.

Money statement.

July 1, 1900, balance unexpended	\$5,000. 00
July 1, 1901, balance unexpended	5,000. 00
{ Amount (estimated) required for completion of existing project	309,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	100,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The following is the amount and date of appropriation for improving harbor of Southwest Baltimore (Spring Garden), Maryland:

June 23, 1896.....	\$5,000
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The statistics of the port of Baltimore include this harbor.

I 5.

IMPROVEMENT OF QUEENSTOWN HARBOR, MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

There were no operations in the fiscal year. A history of this harbor is contained in the Annual Report of the Chief of Engineers for 1900, page 219.

Money statement.

July 1, 1900, balance unexpended.....	\$389. 43
June 30, 1901, amount expended during fiscal year.....	4. 25
July 1, 1901, balance unexpended.....	385. 18

AMOUNTS APPROPRIATED.

By act approved—	
March 3, 1871.....	\$5, 000
June 10, 1872.....	6, 000
March 3, 1879.....	3, 000
Total.....	14, 000
By act of June 3, 1896.....	5, 000
Aggregate.....	19, 000

The harbor is in the collection district of Baltimore.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bricks, flour, lumber, etc.....	652	\$11, 800
Fruits, grain, cattle, etc.....	340	44, 684
General merchandise.....	6, 450	385, 800
Total.....	7, 442	442, 284
Shipments:		
Carriages, leather, lumber, etc.....	60	11, 050
Fruits, grain, poultry, etc.....	2, 469	133, 084
General merchandise.....	2, 402	144, 120
Total.....	4, 931	288, 254
Total receipts and shipments.....	12, 373	730, 538

Vessels trading at Queenstown Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips per week.
Steamer.....	1	553	<i>Feet.</i> 6	6

The above statistics were furnished by the Chester River Steamboat Company and the Queen Anne Railroad Company.

I 6.

IMPROVEMENT OF CHESTER RIVER, MARYLAND, FROM CRUMPTON
TO JONES LANDING.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

There were no operations in progress during the fiscal year. The history of the river is contained in the Annual Report of the Chief of Engineers for 1900, page 219.

Money statement.

July 1, 1900, balance unexpended	\$515. 91
June 30, 1901, amount expended during fiscal year	249. 12
July 1, 1901, balance unexpended	266. 79
{ Amount (estimated) required for completion of existing project	5, 412. 50
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	5, 412. 50
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—	
September 19, 1890	\$5, 000
July 13, 1892	3, 000
By act of August 18, 1894	1, 500
By act of June 3, 1896	1, 500
By act of March 3, 1899	3, 200
Total	14, 200

Statistics of the commerce of the river are not available. It is in the collection district of Baltimore.

I 7.

IMPROVEMENT OF CHOPTANK RIVER, MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

No operations were in progress during the fiscal year. See history of the work on page 220, Annual Report of the Chief of Engineers for 1900.

The river is in the collection district of Baltimore.

Money statement.

July 1, 1900, balance unexpended	\$794. 72
June 30, 1901, amount expended during fiscal year	685. 79
July 1, 1901, balance unexpended	108. 93
{ Amount (estimated) required for completion of existing project	19, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$10, 000. 00
For maintenance of improvement	4, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	14, 000. 00

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AMOUNTS APPROPRIATED.

By act approved—		By act approved—	
June 14, 1880.....	\$5,000	September 19, 1890.....	\$7,500
March 3, 1881.....	5,000	July 13, 1892.....	3,000
By act passed August 2, 1882.....	5,000	By act of August 18, 1894.....	2,000
By act approved—		By act of June 3, 1896.....	2,000
July 5, 1884.....	5,000	By act approved March 3, 1899..	8,000
August 5, 1886.....	10,000		
By act of August 11, 1888.....	7,500	Total.....	60,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, ice, oysters, etc.....	4,158	\$21,720
Bricks, canned goods, fertilizers, etc.....	105,214	1,506,243
Fruit, grain, cattle, etc.....	2,466	166,010
General merchandise.....	9,050	543,000
Total.....	120,888	2,236,973
Shipments:		
Cord wood, railroad ties, etc.....	1,045	5,500
Canned goods, fertilizers, sawed lumber, etc.....	5,324	241,597
Fruit, grain, poultry, cattle, etc.....	22,757	628,840
General merchandise.....	7,080	239,800
Total.....	36,206	1,115,737
Total receipts and shipments.....	157,094	3,352,710

Vessels trading in Choptank River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamers.....	5	2,229	<i>Feet.</i> 5½ to 9	Daily.

A large number of sailing vessels also trade in this river, making irregular trips.
The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 8.

IMPROVEMENT OF LA TRAPPE RIVER, MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

No dredging was done in the fiscal year. For history of the work see page 222, Annual Report of the Chief of Engineers for 1900.

This river is in the collection district of Baltimore.

Money statement.

July 1, 1900, balance unexpended.....	\$36.13
July 1, 1901, balance unexpended.....	36.13
{ Amount (estimated) required for completion of existing project.....	2,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	2,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved July 13, 1892.....	\$2,500
By act August 18, 1894.....	4,750
Total	7,250

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, ice, lime, etc.....	2,375	\$6,725
Bricks, flour, lumber, etc.....	1,730	23,500
Grain, cattle, truck, etc.....	256	10,000
General merchandise.....		125,000
Total.....	4,361	165,225
Shipments:		
Cord wood, etc.....	75	250
Canned goods, sawed lumber, etc.....	593	24,140
Fruit, grain, butter, cattle, hay, etc.....	3,060	77,140
General merchandise.....		1,000
Total.....	3,728	102,530
Total receipts and shipments.....	8,089	267,755

Vessels trading in La Trappe River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamers.....	3	1,177	<i>Feet.</i> 9	6 times a week.
Schooners.....	14	557	5 to 8	From time to time; irregularly.

There are other small vessels running during the grain season.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 9.

IMPROVEMENT OF WARWICK RIVER, MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

There were no operations in this fiscal year. See history of the work in the Annual Report of the Chief of Engineers for 1900, page 222.

This river is in the collection district of Baltimore.

Money statement.

July 1, 1900, balance unexpended	\$183.44
June 30, 1901, amount expended during fiscal year	171.05
July 1, 1901, balance unexpended	12.39
{ Amount (estimated) required for completion of existing project	6,600.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$3,600.00
For maintenance of improvement	3,000.00
	6,600.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

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AMOUNTS APPROPRIATED.

By act approved June 14, 1880	\$3, 000
By act approved March 3, 1881	3, 000
Total	6, 000
By act approved July 13, 1892	6, 000
By act of August 18, 1894	2, 000
By act of June 3, 1896	2, 000
By act of March 3, 1899	2, 000
Total on present project	12, 000
Aggregate	18, 000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, ice, fish, etc	913	\$4,135
Bricks, fertilizers, furniture, etc	2, 594	87, 253
Grain, hay, horses, cattle, etc	1, 382	65, 419
General merchandise	834	50, 040
Total	5, 723	206, 847
Shipments:		
Canned goods, fertilizers, etc	977	47, 510
Fruits, grain, hay, cattle, etc	44, 865	781, 530
General merchandise	1, 226	60, 060
Total	47, 068	889, 100
Total receipts and shipments	52, 791	1, 095, 947

Vessels trading in Warwick River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamers	2	1, 208	<i>Feet.</i> 5½	Daily service, alternately.
Sloops, bugeyes, schooners, etc	100	Unknown.	Unknown.	Irregularly with grain, fertilizers, etc.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 10.

IMPROVEMENT OF NANTICOKE RIVER, DELAWARE AND MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

The work of the fiscal year consisted in dredging 11,738 cubic yards of material by July 25, 1900, thus completing the project. For a history of the improvement see page 224 of the Annual Report of the Chief of Engineers for 1900.

This river is in the collection district of the eastern district of Maryland, Crisfield being the nearest port of entry.

Money statement.

July 1, 1900, balance unexpended	\$2, 806. 03
June 30, 1901, amount expended during fiscal year	1, 953. 17
July 1, 1901, balance unexpended	852. 86

AMOUNTS APPROPRIATED.

By act of June 3, 1896	\$3, 000
By act approved March 3, 1899	3, 000
Total	6, 000

CONTRACT IN FORCE.

A contract was in force with the Baltimore Dredging Company for dredging, at 12 $\frac{1}{10}$ cents per cubic yard, approved October 18, 1899; commenced June 29, 1900, and completed July 25, 1900.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Raw bone, phosphates, ship timber, etc	385	\$7, 932
Fertilizers, flour, lumber, etc	75, 309	457, 482
Cattle, horses, hay, etc	636	30, 430
General merchandise	1, 250	75, 000
Total	77, 580	570, 44
Shipments:		
Canned goods, basket and barrel material, etc	2, 827	132, 750
Berries, peaches, grain, poultry, etc	5, 860	253, 410
General merchandise	1, 200	72, 000
Total	9, 887	458, 160
Total receipts and shipments	87, 467	1, 029, 004

Vessels trading in Nanticoke River, Delaware and Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamer	1	459	<i>Feet.</i> 6	Triweekly.
Schooners and sloops	Unknown.	1, 200	5 to 7	Grain, lumber, and fertilizers.

Fifty-five sailing vessels, of a tonnage of 750, repaired during the year.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 11.

IMPROVEMENT OF BROAD CREEK RIVER, DELAWARE.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

No dredging was done during the fiscal year. For a history of the work see page 224 of the Annual Report of the Chief of Engineers for 1900.

This work is in the collection district of Delaware, Wilmington being the nearest port of entry. The statistics of the commerce of the river were unobtainable.

Money statement.

July 1, 1900, balance unexpended	\$3,560.87
June 30, 1901, amount expended during fiscal year.....	3,175.12
July 1, 1901, balance unexpended	385.75

AMOUNTS APPROPRIATED.

By act approved—		By act approved July 13, 1892...	\$5,000
June 14, 1880.....	\$5,000	By act of August 18, 1894	5,000
March 3, 1881.....	10,000	By act of June 3, 1896	5,000
By act passed August 2, 1882....	5,000	By act approved March 3, 1899..	5,000
By act approved August 5, 1886..	10,000		
By act of August 11, 1888.....	5,000	Total, present project	20,000
Total	35,000	Aggregate.....	55,000

I 12.

IMPROVEMENT OF WICOMICO RIVER, MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

No operations were in progress during the fiscal year. See history of the work on page 226, Annual Report of the Chief of Engineers, for 1900.

This river is in the eastern collection district of Maryland, Crisfield being the nearest port of entry. Only partial statistics were obtained and they are as follows:

Money statement.

July 1, 1900, balance unexpended.....	\$2.00
July 1, 1901, balance unexpended.....	2.00
Amount (estimated) required for completion of existing project.....	6,798.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	6,798.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNTS APPROPRIATED.

By act of—

June 10, 1872	\$5,000
March 3, 1873	5,000
June 28, 1874	5,000
March 3, 1875	5,000
August 14, 1876	5,000
June 18, 1878	5,000
March 3, 1879	3,000
June 14, 1880	5,000
March 3, 1881	2,000
July 5, 1884	10,000
Total	50,000
September 19, 1890	10,000
July 13, 1892	6,500
August 18, 1894	3,000
June 3, 1896	3,700
Total on present project	23,200
Aggregate	73,200

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Ice, oysters, fish, etc	205	\$5,004
Brick, fertilizers, furniture, etc	3,064	225,995
Cattle, horses, hay, etc	380	30,296
General merchandise	6,774	406,440
Total	10,423	667,735
Shipments:		
Canned goods, lumber, fertilizers, etc	975	37,550
Berries, hay, cattle, etc	1,707	120,908
General merchandise	1,605	96,300
Total	4,287	254,758
Total receipts and shipments	14,710	922,493

Vessels trading in Wicomico River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamer	1	704	<i>Fect.</i> 5½	Triweekly.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 13.

IMPROVEMENT OF MANOKIN RIVER, MARYLAND.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

Under a contract with the Baltimore Dredging Company, which was commenced August 2, 1900, and completed on the 15th of that month,

the mud flats were dredged to the projected depth and 80 feet width for a distance of 1,270 feet, removing 10,388 cubic yards of material. See Annual Report of the Chief of Engineers for 1900, page 227, for a detailed history of the river.

The amount expended during the fiscal year 1900 was \$3,848.38, and not \$3,848.28, as appears in the annual report for that year, leaving the balance unexpended July 1, 1900, \$1,676.62 instead of \$1,676.72.

This river is in the collection district of the eastern district of Maryland, and Crisfield is the nearest port of entry. The statistics of the commerce of the river were unobtainable.

Money statement.

July 1, 1900, balance unexpended	\$1,676.62
June 30, 1901, amount expended during fiscal year	1,438.67
July 1, 1901, balance unexpended	237.95
{ Amount (estimated) required for completion of existing project.....	7,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$7,500.00
For maintenance of improvement	4,000.00
	11,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNTS APPROPRIATED.

By act approved—	
September 19, 1890	\$7,500
July 13, 1892	7,500
Act of August 18, 1894	4,000
Act of June 3, 1896	14,000
Act of March 3, 1899	1,500
Total	24,500

CONTRACT IN FORCE.

A contract was in force with the Baltimore Dredging Company for dredging at 12¹/₁₆ cents per cubic yard, approved October 18, 1899, commenced August 2 and completed August 5, 1900.

I 14.

IMPROVEMENT OF POCOMOKE RIVER, MARYLAND, BELOW SNOWHILL.

[This work was in the charge of Gen. William F. Smith, United States agent, to May 15, 1901.]

Dredging under the contract was begun August 24, 1900, and completed on the 21st of the succeeding month. The quantity of material removed was 20,192 cubic yards, and the dredging extended over 2,920 feet of the length of the channel, which was made of the proj-

¹ Of this amount \$2,000 is for work in the upper river not covered by project.

ect dimensions. See history of the work on page 228, Annual Report of the Chief of Engineers for 1900.

This river is in the collection district of the eastern district of Maryland, and Crisfield is the nearest port of entry.

Money statement.

July 1, 1901, balance unexpended	\$3, 134. 31
June 30, 1901, amount expended during fiscal year	2, 985. 23
July 1, 1901, balance unexpended	149. 08
Amount (estimated) required for completion of existing project	6, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	6, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—	
June 18, 1878	\$10, 000. 00
March 3, 1879	2, 500. 00
August 5, 1886	8, 000. 00
Total	20, 500. 00
By act of June 3, 1896	\$5, 000. 00
By act approved March 3, 1899	3, 000. 00
Total on present project	8, 000. 00
Aggregate	28, 500. 00

CONTRACT IN FORCE.

A contract was in force with the Baltimore Dredging Company for dredging at 12 $\frac{3}{10}$ cents per cubic yard, approved October 18, 1899, commenced August 24 and completed September 21, 1900.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1900.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, dimension stone, ice, etc	282	\$1, 794
Fertilizers, flour, millwork, etc	144, 465	794, 863
Cattle, hogs, horses, etc	813	23, 350
General merchandise	10, 000	600, 000
Total	155, 560	1, 420, 007
Shipments:		
Cord wood, logs, ship timber, etc	3, 010	35, 568
Canned goods, crates, lumber, etc	19, 710	214, 678
Fruit, grain, eggs, poultry, etc	5, 149	109, 017
Total	27, 869	359, 263
Total receipts and shipments	183, 429	1, 779, 270

Vessels trading in Pocomoke River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamer.....	1	654	<i>Feet.</i> 6½	Semiweekly.
Schooners and sloops ...	Unknown ..	6,610	5 to 7	For grain, lumber, fertilizers, etc.

Ninety-four sailing vessels of an aggregate tonnage of 4,800 repaired during the year.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 15.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Schooner Wm. H. Roach.—See previous history on page 1661 of the Annual Report of the Chief of Engineers for 1900. The wreck was sunk in 1899 between Fishing and Maddox Islands, in the Manokin River, Maryland, where it was abandoned and an obstruction to navigation, and the award of the contract for its removal was under consideration at the close of the fiscal year 1900. A contract was entered into July 7, 1900. The wreck was broken up with dynamite on the 30th of the same month and the débris placed ashore above high water. The total cost of the work was \$399.45.

Bugeye Columbia.—See previous history on page 1661 of the Annual Report of the Chief of Engineers for 1900. The wreck sunk in February, 1900, near Deals Island wharf, Maryland, where it was abandoned and an obstruction to navigation, and the award of the contract for its removal was under consideration at the close of the fiscal year 1900. A contract was entered into July 7, 1900. The wreck was broken up with dynamite July 27 and 28, 1900, and the débris placed ashore above high water. The total cost of the work was \$399.78.

Sunken logs.—These were reported to be an obstruction to the navigation of Back Creek, Maryland, which is the western outlet for the Delaware and Chesapeake Canal, but as an examination, at a cost of \$14.77, showed that the logs had sunk in the mud to a depth of 10 feet below mean low water and below the average depth of the channel, where they were no longer an obstruction to navigation; their removal was not undertaken.

Sloop Laura Wilhelmina.—This vessel, 35 feet long and 12 feet beam, sunk in Cambridge Harbor, Maryland, in August, 1900, about 50 feet from the wharf of the Wheeler Steamboat Company in 9 feet of water. The wreck was abandoned and was an obstruction to navigation. It was raised and put ashore in the Choptank River about a mile below Cambridge Harbor, where it is no longer an obstruction to navigation. The work was done March 4, 1901, and the total cost of operations was \$84.47.

Schooner Maggie.—This wreck lay in the mouth of North Point Creek, Patapsco River, Maryland, where it sunk in 1899 in 6½ feet of water and about 300 feet from the channel where there were 9½ feet of water. It was abandoned and an obstruction to navigation. With the use of dynamite and the services of the United States steam tender

Sentinel the wreck was entirely removed July 20, 1900, at a cost of \$100.

Schooner-rigged scow Harry Moore.—This vessel was wrecked and sunk October 14, 1900, in Jackson Creek, a tributary of the Chester River, Maryland. It was 70 feet in length, 25 feet beam, and lay in 8½ feet of water; abandoned and an obstruction to navigation. The wreck was broken up with explosions of dynamite December 6, 1900, and the débris removed. The work was done with the services of the U. S. steam tender *Sentinel* at a cost of \$150.

Schooner Sarah E. Vetra.—This wreck was sunk on the western edge of the Fort McHenry channel, immediately opposite Rasin's wharf, in the Patapsco River, Maryland, where it lay in 30 feet of water, abandoned and obstructing the main ship channel leading to the port of Baltimore. The wreck was raised February 2, 1901, towed to Canton Hollow, Baltimore Harbor, and there beached at a total cost of \$250.

Barge Frank Thompson.—This vessel was 100 feet in length, 20 feet beam, and had a cargo of coal when it sunk November 6, 1900, in 14 feet of water, 4,700 feet WNW. ½ W. from the front Craighill channel light in the Chesapeake Bay where it was abandoned. In December of the same year the Boston Marine Insurance Company removed the cargo without cost to the United States, and on the 15th of the following March when the absence of ice permitted, the wreck was broken up with explosions of dynamite and the débris removed so that it was no longer an obstruction to navigation. The U. S. steam tender *Sentinel* was used for the work, and the total cost to the Government was \$290.

Schooner Eldridge, sloop Ephriam Lyttee, sloop Maggie, and hull of an old piledriver.—These craft were wrecked in Cambridge Harbor, Maryland, in 1898 and 1899, were abandoned and an obstruction to navigation. They all lay south of the drawbridge. The *Eldridge* is 75 feet long, 20 feet beam, and lies in 7 feet of water; the *Ephriam Lyttee* is 45 feet long, 18 feet beam, and lies in 7 feet of water; the *Maggie* is of the same dimensions and lies in 4½ feet of water, and the hull of the old pile driver is 20 feet long, 12 feet beam, and lies in 6 feet of water. June 11, 1901, an allotment of \$633 was made for their removal and preliminary arrangements for the operation were in progress at the close of the fiscal year.

The total amount expended in the removal of wrecks during the fiscal year ending June 30, 1901, is \$1,688.47.

CONTRACTS IN FORCE.

The following contracts were in force:

With Charles W. Johnston for removing wreck of schooner *William H. Roach*, at \$360, approved July 24, 1900; commenced and completed July 30, 1900.

With Charles W. Johnston, for removing wreck of bugeye *Columbia*, at \$375, approved July 24, 1900; commenced July 27 and completed July 28, 1900.

I 16.

EXAMINATION AND SURVEY OF HARBOR OF HAVRE DE GRACE,
MARYLAND.

[Printed in House Doc. 73, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 22, 1900.

SIR: I have the honor to submit herewith copies of reports dated August 1 and November 9, 1900, by Gen. William F. Smith, United States agent, major of engineers, United States Army, retired, upon preliminary examination and survey, respectively, of harbor of Havre de Grace, Md., with a view to the removal of rocks near the entrance, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

In the opinion of General Smith, concurred in by the division engineer, Col. Peter C. Hains, Corps of Engineers, the improvement proposed is worthy of being undertaken by the General Government, and a plan for removal of the rocks to a depth of 9 feet is presented. The estimated cost of the work is \$15,000.

Very respectfully, your obedient servant,

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF HARBOR OF HAVRE DE GRACE, MD., WITH
A VIEW TO THE REMOVAL OF ROCKS NEAR THE ENTRANCE.UNITED STATES ENGINEER OFFICE,
Wilmington, Del., August 1, 1900.

SIR: In compliance with your instructions, I have the honor to submit the following report upon a preliminary examination of Havre de Grace, Md., with a view to the removal of rocks near the entrance, for which examination provision is made in the emergency river and harbor act of June 6, 1900.

The examination was made, under my direction, by Mr. George W. T. Miller, assistant engineer, and covered the water front at Havre de Grace from the Philadelphia, Wilmington and Baltimore Railroad Bridge down to Seneca's wharf, a distance of about 1,500 feet and a width of 200 feet.

At the bottom flat rock was found, varying in depth from 12 to 20 feet and over from the surface at low water, with a number of projections of rock having but 4 to 8 feet of water over them. These projections constitute the main obstructions to free navigation to the wharves of the town. A tracing¹ showing the area within which these rocks principally are is inclosed herewith. No reliable estimate of the quantity of rock to be removed can be given until a survey has been made, and this I recommend. The cost is estimated at \$350.

¹Not printed.

The commerce of Havre de Grace reported to me last year was 110,250 tons, valued at \$615,000, and a steamer makes regular trips thence to Baltimore. The commerce, in my opinion, would justify an outlay of, say, \$15,000.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 2, 1900.

Respectfully submitted to the Chief of Engineers, United States Army, and recommended for approval.

PETER C. HAINS,
Colonel, Corps of Engineers.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 8, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of harbor of Havre de Grace, Md., with a view to the removal of rocks near the entrance, made to comply with provisions of the emergency river and harbor act of June 6, 1900.

The locality is reported to be worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
August 8, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

SURVEY OF HARBOR OF HAVRE DE GRACE, MD., WITH A VIEW TO THE
REMOVAL OF ROCKS NEAR THE ENTRANCE.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., November 9, 1900.

SIR: In compliance with Department instructions of August 25, 1900, I have the honor to report upon the survey which has been made of Havre de Grace Harbor, Maryland, with a view to the removal of rocks near the entrance, for which survey provision is made in the emer-

gency river and harbor act of June 6, 1900. The survey was made, under my direction, in September last by Mr. P. F. Causey, jr., surveyor, under the supervision of Mr. George W. T. Miller, assistant engineer.

The results of the survey are shown in the map¹ which is inclosed herewith. I recommend that the rocks be removed to a depth of 9 feet at mean low water, so as to give an unobstructed channel to the wharves of the town. To do this will require the removal of about 700 cubic yards of rock, at an estimated cost of about \$15,000. The expenditure is, in my opinion, justified by the commerce of Havre de Grace, which last year was reported to be valued at \$615,000, representing a tonnage of 110,250.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 10, 1900.

Respectfully submitted to the Chief of Engineers, United States Army, and recommended for approval.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

I 17.

ESTIMATE OF COST OF DEEPENING THE CHANNEL IN CURTIS BAY, BALTIMORE, MARYLAND, TO 30 FEET AND OF WIDENING THE SAME TO 250 FEET; ALSO OF INCREASING THE DEPTH OF THE MAIN SHIP CHANNEL OF PATAPSCO RIVER AND BALTIMORE HARBOR TO 35 FEET AND THE WIDTH TO 1,000 FEET.

[Printed in Senate Doc. No. 118, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, January 28, 1901.

SIR: I have the honor to return herewith concurrent resolution of Congress adopted by the Senate January 19, and concurred in by the House of Representatives January 22, 1901, as follows:

Resolved by the Senate (the House of Representatives concurring), That the Secretary of War be directed to transmit to the Senate an estimate of the cost of deepening the channel of Curtis Bay, Baltimore Harbor, in Maryland, to thirty feet and widening the channel to two hundred and fifty feet; and also an estimate of the cost of increasing the depth of the main ship channel of the Patapsco River and Baltimore Harbor to thirty-five feet and the width thereof to one thousand feet—

¹ Not printed.

and in compliance with the terms of said resolution to submit the accompanying copy of report dated January 26, 1901, by the local engineer officer, Lieut. Col. O. H. Ernst, Corps of Engineers.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF LIEUT. COL. O. H. ERNST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., January 26, 1901.

GENERAL: In compliance with the instructions contained in your letter of the 23d instant, I have the honor to submit the following estimates:

I. For "deepening the channel of Curtis Bay, Baltimore Harbor, in Maryland, to 30 feet and widening the channel to 250 feet."

The quantity of material to be removed is computed to be 1,484,296 cubic yards (scow measurement), which, at 12 cents per yard, will cost \$178,115.52. Adding 10 per cent for engineering and contingencies, the estimate for the improvement is \$195,927.07, or, in round numbers, \$196,000. This estimate is based upon a fairly accurate knowledge of the material to be encountered.

II. For "increasing the depth of the main ship channel of the Patapsco River and Baltimore Harbor to 35 feet and the width thereof to 1,000 feet."

An estimate for this work can not now be made with entire accuracy, for the reason that there is some uncertainty as to the character of the material to be encountered at the greater depth. Before the work is undertaken numerous borings should be made for which neither time nor money is now available. The quantity of material to be removed is computed to be 81,816,914 cubic yards (scow measurement). Assuming it to be of the same general character as that already excavated, with the same proportions of hardpan and soft mud, which is probably not far from the truth, the price may be placed at 11 cents per cubic yard and the cost at \$8,999,860.54. Adding 10 per cent for engineering and contingencies, the estimate becomes \$9,899,846.59. This will provide a channel from Baltimore to deep water in Chesapeake Bay; but to reach the Atlantic Ocean some dredging must be done at York Spit, just above the mouth of York River, where the depth in the bay is less than 35 feet. A channel 35 feet deep and 1,000 feet wide at this place is estimated to cost \$802,938.09, which added to the former sum makes the total estimate for the channel from Baltimore to the ocean, in round numbers, \$10,700,000.

I have had prepared also an estimate for enlarging the channel to a depth of 35 feet, retaining its present width at bottom, 600 feet, which may be found of interest in this connection. It is \$4,802,609.55 for the channel from Baltimore to Chesapeake Bay, to which should be

added \$487,446.20 for the channel at York Spit, making in all, in round numbers, \$5,300,000.

Very respectfully, your obedient servant,

O. H. ERNST.

Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,

Chief of Engineers, U. S. A.

I 18.

ESTABLISHMENT OF HARBOR LINES IN ANNAPOLIS HARBOR, MARYLAND.

NAVY DEPARTMENT,

Washington, April 10, 1901.

SIR: The Department requests that the Chief of Engineers of the Army may furnish the Department for the Bureau of Navigation with a description or chart showing the location of the port warden's line on the water front of the Naval Academy, if such a line has been established.

If this line has not been established, it is suggested that the following line be adopted: Beginning at the foot of Hanover street, 500 feet from the southeast line of Holland street, and running thence northwesterly on a line at right angles to Holland street for a distance of 1,520 feet, running thence northeasterly at right angles to the first line to the outer or northeasterly line of the power-house pier now being built at the Naval Academy.

Very respectfully,

JOHN D. LONG,

Secretary.

The Honorable the SECRETARY OF WAR.

* * * * *

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,

U. S. ARMY,

June 1, 1901.

Respectfully returned to the Secretary of War.

The Secretary of the Navy requests a description or chart showing the location of port warden's line on the water front at the Naval Academy if such line has been established, and if not established, he suggests that the line described within be adopted.

No harbor lines have been established by the United States at Annapolis, and this letter was referred to Lieut. Col. O. H. Ernst, Corps of Engineers, for consideration. He submits for adoption certain lines indicated on the accompanying chart,¹ and I suggest that before action looking to the establishment of these lines is taken by the Secretary of War, the accompanying drawing be submitted to the

¹ Not printed.

Secretary of the Navy with a view to ascertaining from him whether the lines suggested will be acceptable to the naval authorities.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

* * * * *

[Fourteenth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 13, 1901.

Respectfully returned to the Secretary of War.

The Navy Department having expressed its approbation of the pier-head lines shown on the accompanying tracing, I recommend their approval.

The tracing has been prepared for the signature of the Secretary of War.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War June 14, 1901, the approval being indicated on the map.

APPENDIX J.

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES; OF JAMES RIVER AND OF HARBOR AT MILFORD HAVEN, VIRGINIA, AND OF CERTAIN RIVERS IN VIRGINIA ON THE WESTERN SHORE OF CHESAPEAKE BAY; PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

REPORT OF LIEUT. COL. CHAS. J. ALLEN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|--|---|
| 1. Potomac River at Washington, District of Columbia. | 7. Urbana Creek, Virginia. |
| 2. Potomac River below Washington, District of Columbia. | 8. Milford Haven, Virginia. |
| 3. Occoquan Creek, Virginia. | 9. York River, Virginia. |
| 4. Nomini Creek, Virginia. | 10. Mattaponi River, Virginia. |
| 5. Lower Machodoc Creek, Virginia. | 11. Pamunkey River, Virginia. |
| 6. Rappahannock River, Virginia. | 12. James River, Virginia. |
| | 13. Protection of Jamestown Island, Virginia. |

EXAMINATION.

14. Quantico Creek, Virginia.
-

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 20, 1901.

GENERAL: I have the honor to forward herewith my annual report for the fiscal year ended June 30, 1901, for river and harbor works in my charge. * * *

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF POTOMAC RIVER AT WASHINGTON, DISTRICT OF COLUMBIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1901.

Proposals for dredging in the Washington and Virginia channels, to be done under the available balance from the appropriations made by

acts of June 3, 1896, and March 3, 1899, were invited July 3, 1900, and opened August 2, 1900. The contract was awarded to the lowest bidder for the entire work—The Atlantic, Gulf and Pacific Company, of New York, N. Y.

The contractor's dredge, which was at Wilmington, Del., was prepared for transfer to Washington, and had been towed some distance inside the Virginia capes, when on September 18, 1900, a severe gale was encountered. It is reported that the tug was obliged to cast the dredge loose, and that the dredge was driven by the storm into the Atlantic Ocean, where it became a total loss.

The construction of a new dredge was begun at Washington on October 1, 1900, and good progress was made. The hull was launched December 6, 1900, and by February 9, 1901, the machinery had been installed and the dredge completed and ready for work.

In the meantime the contractor had been engaged in constructing embankments for retaining dredged material. This work was begun September 17, 1900, and continued, except at such times as the ground was frozen, until May, 1901, when it was entirely completed.

The commencement of dredging operations was delayed by ice in the river until March 11, 1901, when dredging was begun in the Washington channel, and prosecuted almost continuously night and day until April 25, 1901, when 107,245 cubic yards had been dredged and deposited upon the park, and a channel 21 feet deep and 400 feet wide excavated through the bar at the entrance.

The dredge was at once transferred to the Virginia channel above Long Bridge, where work was begun April 29, 1901, and continued to the close of the fiscal year. In order to relieve navigation in the Virginia channel at the earliest practicable date, the work was first limited exclusively to dredging the west cut 134 feet in width, which at the close of the fiscal year had been practically completed through the entire length of this shoal. The total amount of material dredged from this bar and deposited upon Potomac Park during the fiscal year was 173,918 cubic yards.

The work was delayed by ice and winds at the outset and by freshets during April and May, but notwithstanding these hindrances, good progress has been made, and it is anticipated that all the work provided for under this contract will be completed early in the ensuing fiscal year.

The highest of the freshets of this spring (1901) reached its maximum elevation on April 22, when the surface of the water was about 7.7 feet above mean low tide at the Aqueduct Bridge, 6.7 feet at Easbys Point, and 6.5 feet at Long Bridge. No serious damage was done to property by these freshets, but soundings show that large quantities of silt were deposited by them upon the bar in the Virginia channel above Long Bridge. A sample of river water taken during one of these freshets was allowed to settle in a graduated glass and found to contain 2 per cent of soft mud.

During the year a plain wooden building containing in all five small rooms was erected at Easbys Point, for the use of the watchman stationed there. It replaced an old building formerly used for the same purpose, which had become unfit for habitation. This house was built by hired labor.

A portion of the park area was cleared of brush, some levels were taken on the park, and other similar work incidental to the improvement was done.

CHANNEL DEPTH.

The original, which is also the present, project for this improvement, was adopted by act of Congress of August 2, 1882, and makes the following provision as to channel depth:

It is regarded as necessary to the proper execution of this plan, as thus defined, that the channel depths in both Washington and Georgetown harbors should be sufficient to accommodate the largest draft vessels that can be brought up to Arsenal Point, with such additional depth at the wharves that vessels can receive their full cargoes without grounding at low water.

The projected depth was not stated in feet, but by the above imposed condition was at that time limited to 20 feet at low tide, and this depth was adopted in all estimates for the work.

By act of March 3, 1899, Congress, however, authorized the dredging of channels 24 feet deep at low tide through all shoals in the Potomac River below Washington, D. C. This work is now in progress under a continuing contract, and it is anticipated that it will be completed during the ensuing fiscal year.

Upon the completion of this dredging of the shoals in the Potomac River below Washington, the adopted project for improving the Potomac River at Washington, D. C., will, without any alteration, provide for a similar increase in channel depth at Washington, for which, however, the present estimates make no provision.

The desirability of extending the advantages of increased depth in the lower Potomac River at an early date, so that deep-draft vessels may reach the navy-yard and wharves at Washington, is obvious and need not be dwelt upon here.

The additional material to be excavated in order to establish 24-foot channels at Washington should be deposited upon the reclaimed flats (Potomac Park), and there would thus incidentally result the great advantage of raising the park surface above all possibility of injury by the highest known freshets, as well as the advantage of a dry area for use by the people. (In this connection attention is respectfully invited to page 1189 of my annual report for 1898, Appendix K to the Annual Report of the Chief of Engineers for that year.)

The estimated additional cost of this important improvement is \$592,000, which, however, as Congress has not yet acted upon the matter, has not been incorporated in any money statements or estimates presented in this report.

POTOMAC PARK.

Congress, by act of March 3, 1897, and in the following words, declared the flats now being reclaimed a public park:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the entire area formerly known as the Potomac flats, and now being reclaimed, together with the tidal reservoirs, be, and the same are hereby, made and declared a public park, under the name of Potomac Park, and to be forever held and used as a park for the recreation and pleasure of the people.

The land areas of these reclaimed flats amount to 621 acres, while the areas of the constructed tidal reservoirs aggregate 118 acres. These flats are capable of being transformed into one of the finest parks in the country. The greater part of the park area is composed of rich alluvial soil, dredged from the bed of the river, upon which a luxuriant growth rapidly appears. The dredging operations will continue to afford material of the same character.

It is necessary that the greater part of the area be for the present reserved for the deposit of material dredged from the river channels and tidal reservoir in connection with the improvement of Potomac River, and that sufficient space be temporarily reserved for construction purposes near the sites of the Memorial, Long, and new highway bridges, and of the inlet gates, and though it will probably be some years before the reclaimed area can be devoted exclusively to park purposes, still it appears desirable that a commencement be made upon the park improvement so as to render the park accessible to the public at the earliest practicable day.

If the locations of driveways, lakes, inequalities of surface, etc., for the completed park be known in advance, much of the dredged material can be so deposited as to avoid rehandling; also, if the inlet gates for the regulation of the flow of water into the tidal reservoir be combined in one structure with the bridge for carrying the driveway across the same, a marked increase of economy and effect will result.

It is generally understood that comprehensive plans for the improvement of the park system of Washington, to be submitted to Congress, are to be prepared by a commission composed of distinguished architects and landscape engineers. The definite adoption of some such comprehensive plans for Potomac Park would be of great advantage to the work and to the community at large, even if no appropriation for their execution were immediately made.

Plans for the development of the reclaimed flats into a sort of rural park have been considered by this office, more or less, since the inception, in 1881, of the project for their reclamation, and have been kept in view since that time by the several officers of the Corps of Engineers in charge of the work when considering the crossing by bridges and other related subjects.

The map accompanying this report shows the condition of the channels at the close of the fiscal year 1901, and also suggests features of park improvement, as islands, vistas, driveways, speedway, commons, etc., that may possibly be regarded as of interest.

DUMPING IN POTOMAC PARK.

Deposits by citizens, at their own expense, in Potomac Park of desirable, clean earth, free from objectionable matter, have always been permitted by this office, subject to certain restrictions which guard the interests of the United States. These permits are in regular form and are of record.

During the past year this privilege has been a great convenience to various private parties, and at the same time the United States has obtained, in this way and without cost to itself, about 15,000 cubic yards of good material, deposited and graded free of cost at localities remote from the river, where deposit from dredging is most expensive, or thrown up in embankments which will later serve for retaining and grading deposited material, thus reducing the cost of future dredging and deposit.

If the locations of the driveways of Potomac Park were definitely established, much of such material which now has to be rejected as unsuitable for park surface could be accepted and deposited to the advantage of the river improvement, of the park improvement, and of the community at large.

MAINTENANCE.

The improvement has reached a stage where the maintenance and preservation of the reservation require attention. The growth of weeds and underbrush which, in the summer season especially, renders access to the various parts of the work difficult, should be cleared up each year until the reservation is ready to be laid out and graded. Annual repairs will also be needed on the wall and the reservoir gates.

The proper police supervision of this extensive area of 621 acres has also become a matter of importance. In order to prevent infraction of the law, trespasses, etc., the reservation should be patrolled.

It is estimated that \$5,000 will be required per annum for maintenance.

It is also estimated that the sum of \$395,000 can be profitably expended during the fiscal year ending June 30, 1903, in carrying on work under the approved project. The items making up the foregoing amount are as follows:

Dredging in tidal reservoir, 520,000 cubic yards, at 15 cents.....	\$78, 000
Dredging in Virginia channel, 550,000 cubic yards, at 15 cents.....	82, 500
Dredging in Washington channel, 50,000 cubic yards, at 15 cents.....	7, 500
The dredged material to be deposited upon the reclaimed flats (Potomac Park).	
Extension of training dike about 1,000 feet, and raising existing dike where needed.....	25, 000
Extension, raising, and repair of sea wall.....	25, 000
Maintenance of Potomac Park.....	5, 000
Construction of reservoir inlet gates.....	140, 000
Contingencies, about 10 per cent.....	37, 000
Total.....	400, 000

TRESPASS ON THE GROUNDS OF THE PARK.

A number of unauthorized occupations of portions of the area were reported under date of January 3, 1900, to the proper law officer of the Government. All of these occupants have since then withdrawn, two excepted, and who still occupy small portions of the area between the northeasterly shore line of the large tidal reservoir and the Washington Monument, etc., grounds, one of the portions of the area being occupied by an old and dilapidated building and the other by piles of old lumber belonging to the two persons referred to. The matter has again, and recently, been reported.

Washington is in the collection district of Georgetown, D. C. The nearest light-house is at Jones Point, Virginia.

Money statement.

July 1, 1900, balance unexpended.....	\$129, 896. 18
June 30, 1901, amount expended during fiscal year.....	36, 908. 01
July 1, 1901, balance unexpended.....	92, 988. 17
July 1, 1901, outstanding liabilities.....	650. 00
July 1, 1901, balance available.....	92, 338. 17
July 1, 1901, amount covered by uncompleted contracts.....	64, 543. 00
(Amount (estimated) required for completion of existing project.....)	594, 020. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$395, 000. 00
For maintenance of improvement.....	5, 000. 00
	400, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for the improvement.

August 2, 1882	\$400,000	June 3, 1896	\$100,000
July 5, 1884	500,000	March 3, 1899 (appropriated	
August 5, 1886	375,000	\$100,000; allotted Potomac	
August 11, 1888	300,000	River below Washington,	
September 19, 1890	260,000	\$26,000)	74,000
July 13, 1892	200,000		
August 18, 1894	150,000	Total	2,359,000

CONTRACT IN FORCE.

With Atlantic, Gulf and Pacific Company, of New York, N. Y., for dredging.

Amount: 460,000 cubic yards, more or less, in the Virginia channel above Long Bridge; 80,000 cubic yards, more or less, in the Virginia channel below Long Bridge, and 125,000 cubic yards, more or less, in the Washington channel.

Rate: 12.8 cents per cubic yard for dredging in the Virginia channel, and $14\frac{8}{10}$ cents per cubic yard for dredging in the Washington channel.

Date of contract: August 15, 1900.

Approved: September 5, 1900.

Date for commencement: On or before September 27, 1900; extended to January 27, 1901.

Date for completion: Not less than 50,000 cubic yards of material to be dredged and deposited from the Virginia channel and 30,000 cubic yards from the Washington channel each month, excepting that these amounts of dredging per month will not be required during the months of December, January, and February.

COMMERCIAL STATISTICS.

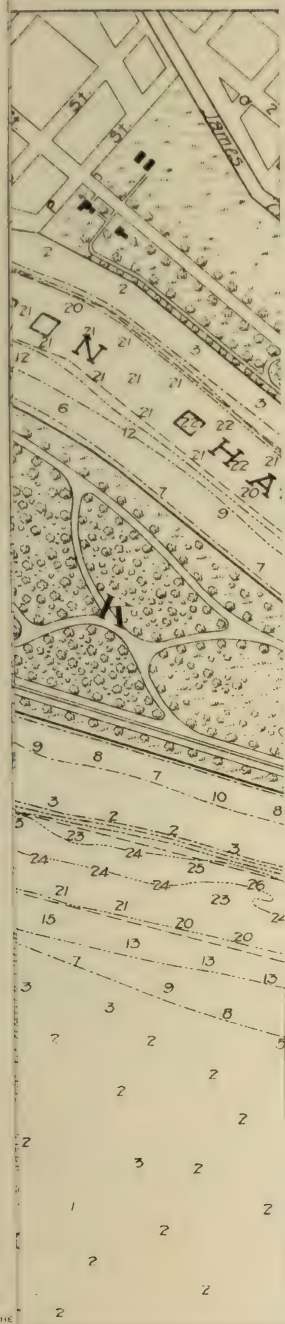
[Furnished by Mr. J. W. Averill, Washington, D. C.]

Receipts and shipments.

Calendar year—	Coal.	Ice.	Lumber.	Sand.	Wood.	Miscellaneous.	Total.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
1887.....	264,947	120,237	37,044	50,000	52,419	94,325	618,972
1888.....	240,836	108,421	45,101	50,000	33,040	104,177	581,575
1889.....	92,511	115,506	41,407	75,000	35,351	128,905	488,680
1890.....	72,089	135,552	69,604	75,000	48,457	118,994	519,696
1891.....	114,913	123,107	50,106	60,000	48,457	154,636	551,219
1892.....	280,342	148,692	68,178	20,000	48,457	261,285	766,954
1893.....	333,837	143,837	33,167	18,000	48,457	76,135	653,433
1894.....	306,743	138,094	36,935	41,850	58,203	62,763	644,588
1895.....	291,268	135,158	51,327	39,284	49,930	127,483	693,450
1896.....	334,293	131,542	44,696	32,400	50,842	129,884	723,657
1897.....	260,328	106,406	38,694	25,500	29,250	133,506	593,684
1898.....	259,517	132,510	40,628	23,400	34,500	154,704	645,239
1899.....	248,125	125,928	65,916	25,000	33,750	130,023	715,549
1900.....	199,274	134,892	63,073	42,000	34,500	111,519	585,258

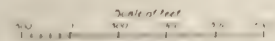
In addition to the foregoing, the estimated amount of miscellaneous freight received and shipped by the Norfolk, Baltimore, and river steamers during the year, as obtained from the agents of the different lines, is 76,162 tons.

The amount of bituminous coal shipped from Georgetown was less than usual on account of the strike in the mines.



POTOMAC RIVER

WASHINGTON, D.C.



NOTES

- 1 ft Contour
- 12
- 10
- 24
- Channel Lines

From mapping data on Atlas of the Potomac River, No. 1901



Number of vessels of various classes arriving and departing.

Calendar year—	Steamers drawing from 5 to 15 feet, 100 to 600 tons.	Vessels drawing from 10 to 21 feet, 300 to 2,600 tons.	Vessels drawing from 4 to 10 feet, 30 to 400 tons.	Barges draw- ing from 5 to 12 feet, 100 to 700 tons.
1887	970	573	2,149	993
1888	710	525	1,588	2,821
1889	675	455	1,563	929
1890	696	491	1,572	286
1891	980	445	1,854	862
1892	1,065	466	2,046	527
1893	906	431	2,301	450
1894	1,118	455	2,388	323
1895	1,060	442	2,055	290
1896	955	527	2,367	325
1897	939	470	2,165	330
1898	1,213	391	1,975	366
1899	1,220	372	1,867	486
1900	1,345	368	1,920	512

Ferry and local passenger steamers, tugs, canal boats, or scows are not included in the above.

J 2.

IMPROVEMENT OF POTOMAC RIVER BELOW WASHINGTON, DISTRICT OF COLUMBIA.

CONTINUING CONTRACT.

A continuing contract for dredging the shoals in the Potomac River below the city of Washington, D. C., was entered into with Rittenhouse Moore, of Mobile, Ala., November 1, 1899. The contract was approved on the 14th of the same month. The work was to begin December 15, 1899, dredging operations to be continued as long as funds should be available or appropriations should be made for the work, not less than 50,000 cubic yards to be dredged each month; work might be suspended during December, January, February, and March.

Dredging under this contract was in progress at the close of the past fiscal year.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1901.

Dredging at Mattawoman Shoal was continued by the contractor, very satisfactory progress being made until November 15, 1900, when the dredge was removed from the work for the purpose of repairs. From September 17 to the close of the work for the season the dredge was operated night and day.

At the conclusion of the season's work final soundings were taken, and then all the range piles were removed from the river. This work was completed on December 6, 1900.

The laying out of the range lines in the spring was greatly delayed by winds, and was not completed until April 23, 1901.

The contractor resumed dredging at Mattawoman Shoal April 24, 1901, with a dredge of smaller capacity than that employed the previous season, and, although work was prosecuted continuously to the close of the fiscal year, the progress made was not as great as was desired.

Range lines for dredging have been partly staked out at Smiths Point shoals, the next obstruction below Mattawoman, and it is anticipated that the contractor will begin operations there at an early date with the dredge employed at Mattawoman shoal last season.

In all 452,740 cubic yards were dredged at Mattawoman shoal during the past fiscal year. The work was somewhat delayed by winds and by repairs and other causes incident to work of this character.

An examination of the beds of hard material crossing the channel at Mattawoman shoal has been made sufficient to show that it can not be entirely removed under the present contract and specifications. As soon as the United States plant now engaged in making borings in the channel above Long Bridge, Washington, with reference to plans for a highway bridge, becomes available for other work it will be dispatched to Mattawoman shoal in order that conclusive examinations as to the extent of the beds of hard material, including rock, may be made with a view to channeling through them. The soundings made during the progress of the dredging, as well as the records of scow measurements of dredged material, show the amount necessary to be dredged as considerably in excess of that given in the report of 1891. Soundings recently taken over Smiths Point shoals show a similar increase.

A project for the expenditure of the appropriation of \$98,000 made by the sundry civil act of March 3, 1901, was submitted March 23 and approved March 27, 1901.

For commercial statistics see report on improving Potomac River at Washington, D. C., to which should be added a tonnage of about 300,000 due to trade at Alexandria, Quantico, and other points below Washington.

Lower Potomac River is in the collection district of Alexandria, Va. The nearest light-house to Alexandria is at Jones Point, Virginia, and the nearest one to the mouth of the river is at Smiths Point.

Money statement.

July 1, 1900, balance unexpended	\$66,141.28
Amount appropriated by sundry civil act approved March 3, 1901.....	98,000.00
	164,141.28
June 30, 1901, amount expended during fiscal year	37,453.73
July 1, 1901, balance unexpended	126,687.55
July 1, 1901, outstanding liabilities	733.00
July 1, 1901, balance available	125,954.55
July 1, 1901, amount covered by uncompleted contracts.....	26,120.00

APPROPRIATIONS.

March 3, 1899 (by allotment from appropriation of \$100,000 for improving Potomac River, etc.)	\$26,000
June 6, 1900.....	52,000
March 3, 1901	98,000
Total	176,000

CONTRACT IN FORCE.

With Rittenhouse Moore, of Mobile, Ala., for dredging.

Amount: 960,000 cubic yards, more or less.

Rate: 7.2 cents per cubic yard at Mattawoman shoal, Smiths Point shoals, Maryland Point shoal, and 7 cents per cubic yard at Kettlebottom shoal.

Date of contract: November 1, 1899.

Approved: November 14, 1899.

Date for commencement: December 14, 1899.

Date for completion: Dredging operations to be continued so long as funds are available and appropriations may be made for the work, not less than 50,000 cubic yards to be dredged in each month.

J 3.

IMPROVEMENT OF OCCOQUAN CREEK, VIRGINIA.

The present project for improvement, adopted December 5, 1890, and following an appropriation of \$10,000, made September 19, 1890, provides for dredging to afford depths of 6 feet and widths of 100 feet, and dike work at bars as follows:

Lower mud, $2\frac{1}{4}$ miles above the mouth of the creek. Length of channel to be dredged 4,500 feet, the "upper section" for about 2,500 feet below Taylors Point to be 100 feet wide, the material to be deposited on the west side of the channel, and the remainder of the channel, or "lower section," to be 150 feet wide.

Upper mud, $3\frac{1}{2}$ miles above the mouth of the creek. A channel about 2,500 feet in length to be dredged, the material to be deposited on the east side of the channel, and the embankment so formed connected with the left bank by a dike 1,000 feet long.

Sand bar, $5\frac{1}{4}$ miles above the mouth. A channel 2,500 feet in length to be dredged, and sheet-pile dikes to be constructed on the west side to maintain the dredged channel. Length of dikes, 2,000 feet.

Occoquan bar, $5\frac{3}{4}$ miles above the mouth. A channel 1,000 feet in length to be dredged and a dike 900 feet long to be constructed on west side to maintain the depth.

The estimated cost of this, the present approved project of 1890, is \$45,000.

The last appropriation for this work was one of \$2,500, made by act of March 3, 1899.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1901.

The funds being practically exhausted, no work of improvement could be undertaken during the past fiscal year.

It having been reported that some shoals had formed in the channel on account of the dredging operations of a dealer in sand, an inspection was made by this office and three small accumulations of sand found in the channel. The sand dealer was communicated with and he removed the lumps.

The sum of \$5,000 can be profitably expended during the fiscal year ending June 30, 1903, in carrying on the improvement as approximately indicated below.

1408 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Dredging lower mud bar, 10,000 cubic yards, at 15 cents	\$1,500
Dredging upper mud bar, 5,000 cubic yards, at 15 cents	750
Repairs to dike at Ocoquan bar	300
Extension of dike at sand bar, 350 linear feet, at \$4	1,400
Repairs to dike at sand bar	200
Contingencies, about 20 per cent	850
Total	5,000

Ocoquan is in the collection district of Alexandria, which is also the nearest port of entry. The nearest light-house is at Fort Washington, Md.

Money statement.

July 1, 1900, balance unexpended	\$404.14
July 30, 1901, amount expended during fiscal year	19.56
July 1, 1901, balance unexpended	384.58
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

The following appropriations have been made:

September 19, 1890	\$10,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,500
March 3, 1899	2,500
Total	25,000

COMMERCIAL STATISTICS.

[Furnished by Messrs. L. Ledman and Tyson Janney, Ocoquan, Va.]

Receipts and shipments by water.

Articles.	1891.	1892.	1894.	1895.	1896.	1897.	1898.	1900.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	100	100	100	100	100	150	100	100
Fertilizers				200				
Flour and grain	60	550	900	1,400	1,200	900	500	1,600
Lumber	600	800	320	200	300	210	500	200
Piles			1,000	100	2,150		600	2,000
Railroad ties	3,600	3,000	3,600	2,500	7,000	4,000	3,000	2,400
Sand		48,000		5,000	23,400	5,000	11,200	12,000
Wood	3,500	3,600	2,400	750	7,120	2,400	2,240	2,000
Miscellaneous	345	655	580	225	400	3,175	1,725	900
Rock							10,000	48,200
Total	8,205	56,705	8,900	10,475	41,670	15,835	29,865	69,400

Arrival and departure of vessels, 1900.

Class.	Number.
Steam, drawing less than 10 feet	800
Sail, drawing less than 10 feet	160
Barges, flatboats, etc.	640

It is reported that the work done has lessened the cost of shipping, since vessels can now load more heavily at the wharves, whereas formerly part of the cargo had to be taken out to them in lighter-draft boats.

J 4.

IMPROVEMENT OF NOMINI CREEK, VIRGINIA.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1901.

Seven hundred and forty-two linear feet of the east jetty were raised to a height of 4 feet above mean low tide, completing the work of raising this jetty. The materials for the work were furnished under contract and the work was done by hired labor and the use of the Government plant, bids for doing the entire work under contract having been rejected, the previous year, as too high.

At the completion of the raising of the jetty there was still a considerable sum available for the work, and proposals were invited for materials for further extending the jetty. The bids were considered too high and, as the Government plant was needed elsewhere, it was decided to defer further extension until the next working season, excepting that the materials remaining on hand after the completion of the raising of the jetty and a small additional amount of stone purchased in open market were placed in the work. With this material the jetty was extended 34 feet in the water and 19 feet on White Point, making its total length 872 linear feet.

This work was satisfactorily completed October 23, 1900, and the Government plant taken to York River, Virginia.

During the raising and extending of the jetty 433 cubic yards of quarry stone were removed and relaid; 484.7 cubic yards of new quarry stone and 1,162.3 cubic yards of oyster shells purchased and laid; and 389 cubic yards of sand excavated. The total cost for materials, labor, fuel, additional plant, repairs, etc., was \$5,331.31. The cost of the same work, exclusive of inspection, if done by contract at the prices named in the bid opened August 2, 1899, would have been \$11,337.21.

BENEFIT TO COMMERCE AND NAVIGATION.

An idea of the value of the improvement can be obtained by inspecting the table of commercial statistics given below.

The sum of \$12,000 can be profitably expended during the fiscal year ending June 30, 1903, in dredging and jetty construction.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blackistone Island.

Money statement.

July 1, 1900, balance unexpended	\$7,963.13
June 30, 1901, amount expended during fiscal year	4,796.75
July 1, 1901, balance unexpended	3,166.38
{ Amount (estimated) required for completion of existing project	35,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	12,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

The following appropriations have been made:

May 3, 1873	\$10,000	September 19, 1890	\$5,000
June 23, 1874	6,000	July 13, 1892	10,000
March 3, 1875	5,000	August 18, 1894	5,000
March 5, 1879	2,500	June 3, 1896	2,500
June 14, 1880	5,000	March 3, 1899	10,000
March 3, 1881	2,000		
August 2, 1882	2,000	Total	70,000
August 11, 1888	5,000		

CONTRACTS IN FORCE.

With Jerry Valliant, of Oxford, Md., for oyster shells.
Amount: 1,200 cubic yards, more or less.
Rate: 94 cents per cubic yard.
Date of contract: May 29, 1900.
Approved: June 7, 1900.
Date for commencement: June 18, 1900.
Date for completion: Delivery of from 100 to 300 cubic yards of oyster shells, regularly, per week, according to instructions from the engineer officer in charge.

With James McCuen, of Alexandria, Va., for quarry stone.
Amount: 370 cubic yards, more or less.
Rate: \$2.10 per cubic yard.
Date of contract: May 28, 1900.
Approved: June 4, 1900.
Date for commencement: June 15, 1900.
Date for completion: Delivery of from 50 to 150 cubic yards of stone, regularly, per week, according to instructions from the engineer officer in charge.

COMMERCIAL STATISTICS.

Receipts and shipments by water.

[Furnished by Mr. F. E. Tubman, Mount Holly, Va.]

Articles.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	10	8	10	8	10	5	10
Farm produce	100	150	100	150	125	150	3,000
Grain	400	500	4,500	4,000	3,500	3,000	3,000
Lumber	500	400	6,000	5,000	400	100	300
Oysters	5,000	4,000	3,500	3,000	500	500	400
Railroad ties	5,000	4,500	3,000	3,000	2,000	2,500	2,000
General merchandise	10,000			90	90	115	100
Wood		8,000	1,000		800	1,000	800
Ice							30

Repeated efforts were made to obtain commercial statistics for 1899 and 1900, but they could not be procured.

IMPROVEMENT OF LOWER MACHODOC CREEK, VIRGINIA.

The available funds having been practically exhausted, no work for improvements could be undertaken during the past fiscal year.

The sum of \$2,100 can be profitably expended during the fiscal year ending June 30, 1903, in continuance of dredging.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is at Blackistone Island.

Money statement.

July 1, 1900, balance unexpended	\$222. 13
July 1, 1901, balance unexpended	222. 13
{ Amount (estimated) required for completion of existing project.....	2, 100. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	2, 100. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

The following appropriations have been made:

July 13, 1892.....	\$3, 000
August 18, 1894	3, 000
June 3, 1896	1, 500
March 3, 1899.....	1, 500
Total	9, 000

COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics pertaining to this work, but without success.

J 6.

IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1901.

Dredging under contract with John Miller, of Washington, D. C., which was in progress at the end of the last fiscal year, was continued until September 26, 1900, when the work provided for under this contract was completed. The channel through Pollock's bar was entirely completed to a width of 100 feet and a depth of 10 feet by July 5, and the remainder of the time was spent in dredging a channel of the same dimensions through the lower end of Fredericksburg bar (this being then the shoalest part of that bar) and in excavating a small turning basin at the steamboat wharf. In all, about 19,730 cubic yards of material were dredged, under this contract, during the fiscal year. This material was all deposited behind the dikes at Fredericksburg bar.

It was the intention to expend the balance of the appropriation upon much-needed repairs to the dikes, but the bar at Fredericksburg had in the meantime shoaled by deposits from freshets to such an extent that navigation was difficult and likely to be closed. Upon the urgent request of the navigation interests and the citizens of Fredericksburg, a modified project for the expenditure of the available funds in dredging and such slight repairs to the dikes as might be afterwards made was submitted by the engineer officer in charge March 28, and approved by the Chief of Engineers March 30, 1901.

Proposals for this dredging were invited April 14, 1901, and opened May 14. The contract was awarded to the lowest bidder, W. H. French, of Norfolk, Va., at 32 cents per cubic yard, measured in scows. Work under this contract had not been begun at the close of the fiscal year.

In September, 1900, about 95 linear feet of wattling dike for retaining deposited material was constructed by hired labor. In April, 1901, about 4,400 willow cuttings were planted on the recently made fills in the rear of the dikes, which when grown will protect about 18,000 square yards from erosion by freshets, and several of the cross drains on the fills were cleaned out and repaired. This work was also done by hired labor.

At Fredericksburg bar new deposits of sand are formed by each recurring freshet, this bar being near the head of tide water. The annual reports for a number of years past have referred to the necessity of an annual appropriation of \$7,500 for the removal of these particular deposits. The old timber dikes for the regulation of the channel, built to elevations of about 6 feet above low tide, have suffered greatly from decay, combined with the effects of ice and freshets, and portions of these dikes have been practically destroyed, permitting some of the material deposited behind them to wash back into the channel. The condition of the dikes is rapidly becoming more and more serious. Owing to the meager appropriations which have recently been made for this river, the funds have been mainly required for the maintenance of the channel at Fredericksburg bar, as above referred to; but little could be done toward the maintenance of the dikes or the protection of the newly made fills, and no considerable headway could be made toward the completion of the general project.

The full sum of \$40,000 requested for this improvement is badly needed and can be profitably expended during the fiscal year ending June 30, 1903, in dredging and dike construction and maintenance in accordance with the approved project.

During the ensuing year the unexpended balance will be applied to dredging and temporary repair of dikes at Fredericksburg bar.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Bowler rock.

Money statement.

July 1, 1900, balance unexpended	\$12,960.26
June 30, 1901, amount expended during fiscal year	7,275.97
July 1, 1901, balance unexpended	5,684.29
July 1, 1901, outstanding liabilities	25.00
July 1, 1901, balance available	5,659.29
July 1, 1901, amount covered by uncompleted contracts	3,360.00
Amount (estimated) required for completion of existing project	114,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$30,000.00
For maintenance of improvement	10,000.00
	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

The following appropriations have been made:

March 3, 1871	\$15,000	July 5, 1884	\$20,000
June 10, 1872	15,000	August 5, 1886	20,000
March 3, 1873	15,000	August 11, 1888 (\$15,000, of which	
June 23, 1874	7,000	\$3,000 was for Urbana)	12,000
March 3, 1875	5,000	September 19, 1890	15,000
August 14, 1876	10,000	July 13, 1892	20,000
August 18, 1878	13,500	August 18, 1894	10,000
March 3, 1879	10,000	June 3, 1896	8,000
June 14, 1880	25,000	March 3, 1899	15,000
March 3, 1881	15,000		
August 2, 1882	17,000	Total	267,500

CONTRACTS IN FORCE.

With John Miller, of Washington, D. C., for dredging.

Amount: 21,000 cubic yards, more or less.

Rate: 27 cents per cubic yard.

Date of contract: October 26, 1899.

Approved: November 4, 1899.

Date of commencement: December 1, 1899.

Date for completion (including dredging in Urbana Creek, Virginia, under the same contract): April 30, 1900, extended to August 30, 1900, and again extended to September 30, 1900.

With W. H. French, of Norfolk, Va., for dredging.

Amount: 10,500 cubic yards, more or less.

Rate: 32 cents per cubic yard.

Date of contract: June 4, 1901.

Approved: June 17, 1901.

Date for commencement: On or before July 19, 1901.

Date for completion: On or before September 19, 1901.

COMMERCIAL STATISTICS.

Tonnage for—	Tons.	Tonnage for—	Tons.
1888	83,600	1896	¹ 161,196
1890	83,830	1897	¹ 158,108
1892	¹ 126,333	1898	¹ 166,586
1893	¹ 141,750	1899	¹ 167,862
1894	¹ 144,070	1900	¹ 190,827
1895	¹ 151,466		

The principal articles of commerce are grain, oysters, fertilizers, cattle, farm produce, and general merchandise.

Arrival and departure of vessels, 1900.

	Class.	Number.
Steam:		
Drawing 10 feet or more		640
Drawing less than 10 feet		220
Sail:		
Drawing 10 feet or more		1,190
Drawing less than 10 feet		360
Barges, flatboats, etc		520

It is reported that the work done on this improvement has greatly reduced freight rates, both by rail and water.

¹Furnished by Mr. William D. Scott, Fredericksburg, Va.

J 7.

IMPROVEMENT OF URBANA CREEK, VIRGINIA.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1901.

Proposals for dredging to be done under the available balance of \$779.70 from the appropriation of \$3,000 made by the act of March 3, 1899, were invited September 22, 1900, and opened October 22, 1900, the work to be done under the same contract as that for dredging to be done in York, Mattaponi, and Pamunkey rivers and Milford Haven, Virginia. The contract was awarded to the lowest bidder for the entire work, John Miller, of Washington, D. C., at 24 cents per cubic yard, measured in scows.

The contractor has been engaged at other of the above-named localities and no work was done at Urbana during the fiscal year.

The sum of \$10,000 can be profitably expended during the fiscal year ending June 30, 1903.

Urbana is a port of entry in the collection district of Tappahannock. The nearest light-house is Stingray light.

Money statement.

July 1, 1900, balance unexpended	\$969.32
June 30, 1901, amount expended during fiscal year	191.32
July 1, 1901, balance unexpended	778.00
July 1, 1901, amount covered by uncompleted contracts.....	720.00
{ Amount (estimated) required for completion of existing project	36,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

The following appropriations have been made:

March 3, 1879	\$5,000	September 19, 1890.....	\$3,000
June 14, 1880.....	2,500	July 13, 1892	3,000
March 3, 1881	4,000	August 18, 1894.....	3,000
August 2, 1882.....	4,000	June 3, 1896.....	3,000
August 11, 1888 (included in an appropriation of \$15,000 for Rappahannock River)	3,000	March 3, 1899	3,000
		Total	33,500

CONTRACT IN FORCE.

With John Miller, of Washington, D. C., for dredging.

Amount: 3,000 cubic yards, more or less.

Rate: 24 cents per cubic yard.

Date of contract: October 29, 1900.

Approved: November 14, 1900.

Date for commencement: December 15, 1900.

Date for completion (including dredging in York, Mattaponi, and Pamunkey rivers, and Milford Haven, Virginia, under the same contract): Within fifteen months from date of commencement, not less than 7,000 cubic yards to be dredged per month.

COMMERCIAL STATISTICS.

Calendar year.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.
	<i>Tons.</i>	<i>Tons.</i>
1891	19,500	22,100
1892	20,095	17,125
1893	55,885	61,290
1894	82,395	88,305
1895	66,530	92,320
1896	137,485	133,925
1897	153,875	181,500
1900	179,543	179,414

Commercial statistics received for 1898 and 1899 were not in a form to be used.

The principal articles of commerce are oysters, railroad ties, coal, grain, lumber, wood, farm produce, guano, and general merchandise.

Arrivals and departures of vessels, 1900.

Class.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.
	<i>Number.</i>	<i>Number.</i>
Steam:		
Drawing 10 feet or more	150	170
Drawing less than 10 feet	1,000	1,200
Sail:		
Drawing 10 feet or more	300	380
Drawing less than 10 feet	3,000	2,800
Barges, flatboats, etc	150	160
Total	4,600	4,710

A daily mail steamer line, running from Carters Creek, or Irvington, to Urbana, was established during 1896. It is reported that the work done on this improvement has greatly reduced freight rates and permitted the use of larger vessels.

J 8.

IMPROVEMENT OF HARBOR AT MILFORD HAVEN, VIRGINIA.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1901.

Dredging under contract with the Norfolk Dredging Company was continued until September 6, 1900, when the channel through the outer bar was completed to the full projected dimensions. The total amount of material dredged under this contract was 29,834.5 cubic yards.

Proposals for dredging the inner bar, to be done under the available balance from the appropriation of March 3, 1899, as authorized by act of June 6, 1900, were invited September 22, 1900, and opened October 22, 1900, the work to be done under the same contract as that for dredging to be done in York, Mattaponi, and Pamunkey rivers and Urbana Creek, Virginia. The contract was awarded to the lowest bidder for the entire work, John Miller, of Washington, D. C., at 16 cents per cubic yard, measured in scows.

No dredging has been done under this contract during the past fiscal year, the contractor having been engaged at other of the foregoing localities. The dredging, however, will be done during the coming fiscal year.

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The sum of \$5,000 can be profitably expended during the fiscal year ending June 30, 1903.

Milford Haven is in the collection district of Newport News, Va., which is the nearest port of entry. The nearest light-house is Stingray light.

Money statement.

July 1, 1900, balance unexpended	\$10,981.79
June 30, 1901, amount expended during fiscal year	7,372.79
July 1, 1901, balance unexpended	3,609.00
July 1, 1901, amount covered by uncompleted contracts	1,920.00
{ Amount (estimated) required for completion of existing project	5,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATION.

The following appropriation has been made:

March 3, 1899	\$12,500
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CONTRACTS IN FORCE.

With Norfolk Dredging Company, of Norfolk, Va., for dredging.

Amount: 34,000 cubic yards, more or less.

Rate: 24 cents per cubic yard.

Date of contract: March 5, 1900.

Approved: March 19, 1900.

Date for commencement: May 1, 1900.

Date for completion: July 23, 1900; extended to October 21, 1900.

With John Miller, of Washington, D. C., for dredging.

Amount: 12,000 cubic yards, more or less.

Rate: 16 cents per cubic yard.

Date of contract: October 29, 1900.

Approved: November 14, 1900.

Date for commencement: December 15, 1900.

Date for completion (including dredging in York, Mattaponi, and Pamunkey rivers and Urbana Creek, Virginia, under the same contract): Within fifteen months from date of commencement, not less than 7,000 cubic yards to be dredged per month.

COMMERCIAL STATISTICS.

[Furnished by Baltimore, Chesapeake and Atlantic Railway Company.]

Class of goods.	1900.	Class of goods.	1900.
	<i>Tons.</i>		<i>Tons.</i>
Coal	10	Ice	8
Crabs	79	Iron	24
Farm produce	176	Live stock	53
Fish	102	Lumber	8
Fertilizer	27	Mill products	81
Flour	164	Oysters	13,634
General merchandise	629	Wood	2
Grain	34		

Vessels arriving and departing.

Class.	1900.	Tonnage.
Steam, drawing less than 10 feet.....	4	2,400
Sail, drawing 10 feet or more	6	500
Sail, drawing less than 10 feet	60	4,000

J 9.

IMPROVEMENT OF YORK RIVER, VIRGINIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1901.

Proposals for dredging to be done under the available balance from the appropriation of \$10,000 made by the act of March 3, 1899, were invited September 22, 1900, and opened October 22, 1900, the work to be done under the same contract as that for dredging to be done in Mattaponi and Pamunkey Rivers, Milford Haven and Urbana Creek, Virginia. The contract was awarded to the lowest bidder, John Miller, of Washington, D. C., at 16 cents per cubic yard, measured in scows.

The contractor's dredge arrived at the site of the work on December 31, 1900, and on January 16, 1901, work was begun on excavating a trench behind the dike for the deposit of material dredged from the channel.

Dredging in the channel was begun March 8, 1901, and has been in progress continuously to the end of the fiscal year, except at such times as work was required in shaping up the trench to receive further deposits of material.

The dredge employed by the contractor is small and many delays occurred due to high winds, freshets, accidents to tug, and repairs to plant, so that the work has not progressed as rapidly as was desired. The total amount of material dredged from the channel during the past fiscal year has been 22,725 cubic yards, and has resulted in affording a channel 400 feet wide, at least 20 feet deep, and about 1,200 feet long through what was, previous to this dredging, the shoalest and narrowest portion of the navigation channel. This material was deposited mainly behind and against the dike, adding greatly to its stability, though a small amount was deposited in depressions immediately in front of the dike.

During the unprecedentedly dry weather of the summer of 1900 the teredo became active in the vicinity of West Point to an extent never before experienced, and the dike suffered along with other neighboring structures. This, together with the beating of the waves against the dike, necessitated considerable strengthening before it was in condition to receive the mud to be deposited behind it. The construction of a transverse dike 400 feet long was also necessary to retain the material deposited behind the main dike.

This work of dike construction and repair was done by hired labor and use of the United States plant, the materials required being purchased. The work was begun November 6, 1900, and completed, as far as the available funds would permit, by March 30, 1901, when the Government plant was brought to Washington, D. C. In all, 400 linear

feet of retaining dike were constructed; about 1,800 linear feet of main dike were entirely, and about 1,700 linear feet partially, reenforced; about 70 additional battens driven, and about 700 bags of sand placed against the dike. The work was greatly delayed by winds, high tides, and freshets.

The sum of \$10,000 can be profitably expended during the fiscal year ending June 30, 1903, for the maintenance of the dike and the improvement of the channel.

For full report of improvement of York River, Virginia, see Appendix I to the Annual Report of the Chief of Engineers for 1896.

This work is in the collection district of Richmond, Va., which is the nearest port of entry. The nearest light-house is Bell rock, in the Fifth light-house district.

Money statement.

July 1, 1900, balance unexpended	\$11,576.77
June 30, 1901, amount expended during fiscal year	8,441.98
July 1, 1901, balance unexpended	3,134.79
July 1, 1901, outstanding liabilities	342.79
July 1, 1901, balance available	2,792.00
July 1, 1901, amount covered by uncompleted contracts	2,792.00
(Amount (estimated) required for completion of existing project	69,050.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$8,000.00
For maintenance of improvement	2,000.00
	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

The following appropriations have been made:

June 14, 1880	\$10,000	July 13, 1892	\$35,000
March 3, 1881	25,000	August 18, 1894	20,000
August 2, 1882	25,000	June 3, 1896	16,090
July 5, 1884	20,000	March 3, 1899	10,000
August 5, 1886	18,750		
August 11, 1888	30,000	Total	239,750
September 19, 1890	30,000		

These appropriations have been applied to work under the original project of 1880, the amended project of 1884, and the further amended project of 1887.

CONTRACT IN FORCE.

With John Miller, of Washington, D. C., for dredging.

Amount: 40,000 cubic yards, more or less.

Rate: 16 cents per cubic yard.

Date of contract: October 29, 1900

Approved: November 14, 1900.

Date for commencement: December 15, 1900.

Date for completion (including dredging in Mattaponi and Pamunkey Rivers, Milford Haven and Urbana Creek, Virginia, under the same contract): Within fifteen months from date of commencement; not less than 7,000 cubic yards to be dredged per month.

COMMERCIAL STATISTICS.

[Furnished by Mr. E. T. Lamb, Westpoint, Va.]

Receipts and shipments.

Class of goods.	1891.	1892.	1893.	1894.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal.....	10,960	10,498	10,423	20,000
Cotton.....	89,227	63,742	67,485	72,235
Farm produce.....	5,641	3,500	4,000	5,000
Grain.....	3,200	.....	100	150
Iron.....	43,897	45,501	45,033	41,227
Lumber.....	7,848	6,081	7,375	8,175
Oysters.....	12,400	2,780	3,200	2,500
General merchandise.....	70,930	191,462	188,054	206,706
Railroad ties.....	14,140	5,000	6,500	1,600
Tobacco.....	175	8,500	10,000	12,115
Wood.....	45,900	8,495	9,220	10,000

Vessels arriving and departing.

Class.	1891.	1892.	1893.	1894.
Steamers drawing 10 feet or more.....	727	724	792	758
Steamers drawing less than 10 feet.....	104	208	311	310
Vessels drawing 10 feet or more.....	178	96	90	95
Vessels drawing less than 10 feet.....	824	190	204	200
Barges, flatboats, etc.....	191	18	21	10

Repeated efforts were made to obtain commercial statistics for years subsequent to 1894, but they could not be obtained. From information procured by Mr. W. B. Harrison, surveyor, of this office, it appears that while the commerce of the river is of less importance at present than in former years, there is still a considerable passenger and freight traffic between Westpoint and Baltimore and locally on the river, the principal articles of commerce being tobacco, railroad ties, wood, machinery, iron, salt, farm produce, and manufactured articles, carried in vessels drawing from 12 to 20 feet of water, two of them being foreign steamers. Practically all of the freight which passes over the Southern Railway between Baltimore and Richmond goes by the York River route.

It is stated that the principal line of steamers navigating this river carried 59,273 tons of freight during the year 1900.

J 10.

IMPROVEMENT OF MATTAPONI RIVER, VIRGINIA.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1901.

Proposals for dredging to be done under the available balance from the appropriation of \$2,500 made by the act of June 3, 1896, were invited September 22, 1900, and opened October 22, 1900, the work to be done under the same contract as that for dredging to be done in York and Pamunkey rivers, Milford Haven, and Urbana Creek, Virginia. The contract was awarded to the lowest bidder for the entire work, John Miller, of Washington, D. C., at 23 cents per cubic yard, measured in scows.

The contractor has been engaged at other of the above localities, and no work was done in Mattaponi River during the fiscal year.

BENEFIT TO COMMERCE AND NAVIGATION.

The work already done upon this river has been of benefit to existing commerce, notwithstanding that much of it has had to be done over again, as snags and other obstructions form in greater or less degree after every freshet. Before any work of improvement was undertaken the trade was limited. The total freight tonnage for 1900 was 42,500 tons. In this connection see commercial statistics herewith.

The sum of \$3,000 can be profitably expended during the fiscal year ending June 30, 1903, in continuing work under the approved project.

For full account of the improvement of Mattaponi River see Appendix I 10 to the Annual Report of the Chief of Engineers for 1896.

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is at Bell Rock, Virginia.

Money statement.

July 1, 1900, balance unexpended	\$4, 121. 32
June 30, 1901, amount expended during fiscal year	10. 08
July 1, 1901, balance unexpended	4, 111. 24
July 1, 1901, amount covered by uncompleted contracts.....	2, 668. 00
{ Amount (estimated) required for completion of existing project	42, 300. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

The following appropriations have been made:

June 4, 1880	\$2, 500	July 13, 1892	\$4, 000
March 3, 1881	3, 300	August 18, 1894.....	4, 000
July 5, 1884	2, 500	June 3, 1896	2, 500
August 5, 1886	5, 000		
August 11, 1888	3, 000	Total	29, 800
September 19, 1890.....	3, 000		

CONTRACT IN FORCE.

With John Miller, of Washington, D. C., for dredging.
Amount: 11,600 cubic yards, more or less.
Rate: 23 cents per cubic yard.
Date of contract: October 29, 1900.
Approved: November 14, 1900.
Date for commencement: December 15, 1900.
Date for completion (including dredging in York and Pamunkey rivers, Milford Haven, and Urbana Creek, Virginia, under the same contract): Within fifteen months from date of commencement, not less than 7,000 cubic yards to be dredged per month.

COMMERCIAL STATISTICS.

Receipts and shipments.

Class of goods.	Calendar year—					
	1890.	1891. <i>a</i>	1892. <i>a</i>	1893. <i>a</i>	1894. <i>a</i>	1900. <i>b</i>
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal.....					1,000	
Farm products.....		2,400		300	500	6,000
Grain.....		1,000		100	350	5,000
Lumber.....	7,700	1,200	5,500	6,200	6,000	20,000
Merchandise.....	10,400	3,120	15,570	17,820	16,000	
Ties.....	6,900	5,640	5,000	5,260	3,200	10,000
Wood.....	7,650	38,700	6,620	6,740	12,250	1,500
Total.....	32,650	52,060	32,690	36,420	39,300	42,500

a Furnished by Mr. E. T. Lamb, West Point, Va.*b* Furnished by Mr. J. C. Fox, Aylett, Va.*Vessels arriving and departing during 1894.*

Class.	Number.	Tonnage.
Steam, drawing less than 10 feet.....	175	9,000
Sail, drawing 10 feet or more.....	100	30,000
Sail, drawing less than 10 feet.....	90	15,000
Barges, flatboats, etc.....	5	400
Total.....	370	54,400

Repeated efforts were made to obtain commercial statistics for the years 1895–1898, but they could not be procured. From information obtained mainly from Capt. C. H. Denmead, of the tugboat *Claribel*, it appears that the commerce of the river in 1899 was approximately 44,700 tons, consisting principally of wood, ties, lumber, and grain, carried for the most part in sailing vessels. It is stated that shipments by schooner have largely increased, being about double what they were ten years ago. A steamer makes two trips each way per week between West Point and Walkerton, connecting at the latter place with a steam-propelled scow which runs to Aylett, 18 miles above Walkerton.

J II.

IMPROVEMENT OF PAMUNKEY RIVER, VIRGINIA.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1901.

Proposals for dredging to be done under the available balance from the appropriation of \$2,000 made by the act of June 3, 1896, were invited September 22, 1900, and opened October 22, 1900, the work to be done under the same contract as that for dredging to be done in York and Mattaponi rivers, Milford Haven, and Urbana Creek, Virginia. The contract was awarded to the lowest bidder for the entire work, John Miller, of Washington, D. C., at 23 cents per cubic yard, measured in scows.

The contractor has been engaged at other of the above localities and no work was done in Pamunkey River during the fiscal year. It is expected, however, that the work will be done early in the coming fiscal year.

For full account of improvement of Pamunkey River see Appendix I 11 to the Annual Report of the Chief of Engineers for 1896.

The sum of \$3,000 can be profitably expended during the fiscal year ending June 30, 1903, in dredging and removal of snags, logs, and wrecks.

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, Virginia.

Money statement.

July 1, 1900, balance unexpended	\$2, 881. 57
June 30, 1901, amount expended during fiscal year	6. 40
July 1, 1901, balance unexpended	2, 875. 17
July 1, 1901, amount covered by uncompleted contracts	2, 116. 00
{ Amount (estimated) required for completion of existing project	7, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

The following appropriations have been made:

June 14, 1880.....	\$2, 500	July 13, 1892	\$3, 000
March 3, 1881	2, 500	August 18, 1894.....	2, 000
August 2, 1882.....	2, 500	June 3, 1896.....	2, 000
August 5, 1886.....	5, 000		
August 11, 1888.....	3, 000	Total	25, 500
September 19, 1890.....	3, 000		

CONTRACT IN FORCE.

With John Miller, of Washington, D. C., for dredging.

Amount: 9,200 cubic yards, more or less.

Rate: 23 cents per cubic yard.

Date of contract: October 29, 1900.

Approved: November 14, 1900.

Date for commencement: December 15, 1900.

Date for completion (including dredging in York and Mattaponi rivers, Milford Haven, and Urbana Creek, Virginia, under the same contract): Within fifteen months from date of commencement, not less than 7,000 cubic yards to be dredged per month.

COMMERCIAL STATISTICS.

[Furnished by Mr. E. T. Lamb, West Point, Va.]

Receipts and shipments.

Articles.	1893.	1894.
	<i>Tons.</i>	<i>Tons.</i>
Coal.....	75	5, 000
Grain	100	750
Ice	5, 145	
General merchandise.....	100	10, 000
Lumber	10, 000	1, 000
Railroad ties.....	15, 000	15, 000
Wood	20, 100	10, 500
Total.....	50, 420	42, 250

Repeated efforts were made to obtain commercial statistics for the years 1895–1900, but they could not be procured. From information furnished by Capt. C. H. Denmead, of the tugboat *Claribel*, it appears that the commerce of the river in 1899 amounted to approximately 44,600 tons, consisting principally of wood, lumber, grain, ties, coal, and general merchandise, carried in sailing vessels.

J 12.

IMPROVEMENT OF JAMES RIVER, VIRGINIA.

The work of the fiscal year ended June 30, 1901, for improvement of the river consisted in extension of the 100 by 18 foot channel from the lower city line of Richmond, through Rocketts Reef, to Jetty B, about 900 feet below the city, and in enlarging the channel at Goode Rocks and Richmond bar to 150 by 18 feet. This work was done under the contract entered into October 2, 1899, with P. Sanford Ross, Incorporated, of Jersey City, N. J. The contract was to have been completed on or before February 22, 1901, but extensions of time granted at the request of the contracting firm to enable it to complete the contract brought the date to July 6, 1901. The contract was, however, completed by June 6, 1901.

The work of the year consisted in blasting and dredging hard and soft rock from the channel; in removing cobblestones, earth, etc., from the same, and in repairs of dikes and jetties for regulating the flow of the river.

The quantities of material dredged from the channel during the year were as follows:

Earth.....	cubic yards..	14, 210. 27
Cobblestones	do.....	944. 03
Soft rock	do.....	3, 415. 03
Hard rock	do.....	8, 903. 43
Total.....	do.....	27, 472. 76

The total amounts dredged under the entire contract are as below:

Earth.....	cubic yards..	25, 252. 96
Cobblestones	do.....	2, 354. 03
Soft rock	do.....	7, 758. 84
Hard rock	do.....	15, 306. 26
Total.....	do.....	50, 672. 09

A large proportion of the excavated material was utilized in raising, protecting, and repairing dikes, and in protection of shore.

The sum of \$500,000 is estimated as the amount that can be profitably expended upon this improvement during the fiscal year ending June 30, 1903, in continuing rock and other excavation from the channel between Richmond and the foot of Richmond bar, in repairs and maintenance of jetties, and in widening and deepening the channel by dredging and regulation where necessary below Richmond bar, and mainly at the following-named points:

	Miles below Richmond.
Warwick bar.....	4. 5
Harrisons bar.....	37
Dancing Point shoal.....	59. 5
Swans Point.....	64. 5
Goose Hill flats	71

Approximate estimate.

Rocketts Reef: Enlarging channel between lower city line and Jetty B from 100 by 18 feet to 200 by 18 feet.....	\$75,000
Jetty B to Stearns dike: Enlarging channel from 100 by 18 feet to 200 by 18 feet.....	76,000
Stearns dike to Goode Rocks: Enlarging channel from 100 by 18 feet to 200 by 18 feet.....	90,000
Goode Rocks section: Enlarging channel from 150 by 18 feet to 200 by 18 feet.....	52,000
Richmond bar: Enlarging channel from 150 by 18 feet to 200 by 18 feet....	16,000
Warwick reach: Enlarging channel to 200 by 18 feet and constructing submerged spurs.....	13,000
Harrisons bar: Enlarging channel on upper bar to 400 by 20 feet (gravel) and on lower bar to 400 by 18 feet (sand) and constructing four mattress sills.....	25,000
Dancing Point shoal: Enlarging channel to 400 by 18 feet and constructing two mattress sills.....	46,000
Swans Point: Enlarging channel to 400 by 18 feet and constructing two mattress sills.....	37,000
Goose Hill flats: Enlarging channel to 400 by 18 feet and constructing two mattress sills.....	45,000
Superintendence, office expenses, services, and inspection.....	24,000
Repair of dikes and jetties.....	1,000
Total.....	500,000

In carrying on the improvements on the river below Dutch Gap a suitable steam tug that will withstand rough weather and seas is very much needed. Such a tug would cost about \$25,000. The only steam craft that we have for use on the improvement has an old, worn iron hull, purchased in 1857 and operated by antiquated machinery.

Accompanying is a report in detail by Mr. S. H. Yonge, assistant engineer, of operations for the fiscal year ended June 30, 1901.

Money statement.

July 1, 1900, balance unexpended.....	\$110,393.72
June 30, 1901, amount expended during fiscal year.....	59,363.97
July 1, 1901, balance unexpended.....	51,029.75
July 1, 1901, outstanding liabilities.....	1,197.00
July 1, 1901, balance available.....	49,832.75
July 1, 1901, amount covered by uncompleted contracts.....	9,854.00
{ Amount (estimated) required for completion of existing project.....	3,317,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	500,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

The following appropriations have been made for this work:

July 11, 1870.....	\$50,000	August 2, 1882.....	\$75,000
March 3, 1871.....	50,000	July 5, 1884.....	75,000
June 8, 1872.....	50,000	August 5, 1886.....	112,500
March 3, 1873.....	75,000	August 11, 1888.....	225,000
June 23, 1874.....	50,000	September 19, 1890.....	200,000
March 3, 1875.....	50,000	July 13, 1892.....	200,000
August 14, 1876.....	60,000	August 18, 1894.....	100,000
June 18, 1878.....	70,000	June 3, 1896.....	120,000
March 3, 1879.....	75,000	March 3, 1899.....	150,000
June 14, 1880.....	75,000		
March 3, 1881.....	60,000	Total.....	1,922,500

CONTRACT IN FORCE.

With P. Sanford Ross, Incorporated, of Jersey City, N. J., for dredging, removing rock, repairing jetties, and constructing dike.

Estimated amount of contract: \$84,460.

Date of contract: October 2, 1899.

Approved: October 14, 1899.

Date for commencement: On or before November 3, 1899.

Date for completion: February 22, 1901, extended to May 7, 1901, to June 6, 1901, and to July 6, 1901.

COMMERCIAL STATISTICS.

Receipts and shipments by water during the calendar year 1900.*

Articles.	Port of Richmond, Va.			Points on James River other than Richmond, Va.			Total tonnage.
	Receipts.	Shipments.	Total.	Receipts.	Shipments.	Total.	
Asphalt blocks, brick, etc..	917	1,480	2,397	a 441	17,447	17,888	20,285
Coal	47,175	10	47,185	a 4,706	304	5,010	52,195
Cement, lime, etc.	18,388		18,388	1,276		1,276	19,664
Cattle				3	a 127	130	130
Cotton					27	27	27
Cord wood	1,515	6,752	8,267	754	a 29,203	29,957	38,224
Fertilizer and fertilizer material	19,392	3,402	22,794	a 6,766	42	6,808	29,602
Flour		137	137	198	10	208	345
Fish and oysters	1,018	1	1,019	28	312	340	1,359
Fruit				8	118	126	126
Groceries	1,304		1,304	905	20	925	2,229
Grain	2,258	1,450	3,708	a 417	1,058	1,475	5,183
Hay, straw, etc	102		102	914	820	1,734	1,836
Hogs				17	106	123	123
Horses				130	116	246	246
Ice				12		324	324
Lumber	3,368		3,368	32	a 174,134	174,146	177,514
Logs	36,203	1,379	37,582	84	a 14,606	14,690	52,272
Machinery	2,405	2,654	5,059	257	18	275	5,334
Oil	22,135		22,135	76		76	22,211
Oyster shells				340		340	340
Peanuts					164	164	164
Potatoes				13	52	65	65
Railroad ties	23,573	25,589	49,162	5	9,918	9,923	59,085
Sand	16,705		16,705				16,705
Unclassified freight	62,018	37,498	99,516	a 2,464	1,800	4,264	103,780
Vegetables				1	42	43	43
Total	258,476	80,352	338,828	20,139	250,444	270,583	609,411

a Partly estimated, no reports being received from some of those to whom application for statistics was twice made.

The amounts reported for 1899 were as follows:

Receipts:	Tons.
Brick	45
Coal	103
Fertilizer	5,786
Unclassified freight	1,366
Grain	300
Total	7,600
Shipments:	Tons.
Cattle	51
Cord wood	7,100
Lumber	66,600
Logs	7,075
Unclassified freight	404
Total	81,230

Arrival and departure of vessels during the calendar year 1900.

Class.	Port of Richmond, Va.	
	Number.	Tonnage.
Steam, drawing 5 to 16 feet	1,372	1,155,562
Sail, drawing 4 to 17 feet	570	124,612
Barges, etc.	798	167,422
Total.....	2,740	1,447,596

Returns for points on James River below Richmond, Va., were too incomplete for report.

REPORT OF MR. SAM'L. H. YONGE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Richmond, Va., July 12, 1901.

COLONEL: I have the honor to submit my report of operations pertaining to improving James River, Virginia, for the fiscal year ending June 30, 1901.

The operations were a continuation of those carried on last year, under contract with P. Sanford Ross, Incorporated, dated October 2, 1899, approved October 14, 1899, and comprised extending the 100 by 18-foot channel from Jetty B through Rocketts reef to the lower city line of Richmond, Va., and enlarging the channel at Goode rocks and Richmond bar to 150 by 18 feet.

At the close of the fiscal year ending June 30, 1900, about 42 per cent of the above work was completed. Excavation was completed in 1901 as follows: On Rocketts reef, January 25; Goode rocks, April 30, and Richmond bar, June 6. The work was several times carefully examined with the sweep and found to have a depth of 18 feet below the zero of the Richmond gauge, the assumed plane of mean low water.

* * * * *

The direction of the left side of the improved channel at Rocketts reef is marked by two range stones, the positions of which with reference to street corners at Richmond, Va., is indicated by distances shown on Plate I.¹

The length of channel enlarged at Goode rocks is about 450 feet less than contemplated in the project approved by the Chief of Engineers June 24, 1899, for continuing the improvement under act of Congress approved March 3, 1899, as on account of the present regimen of the river the improvement for the entire length proposed, although accomplished temporarily, was not maintained, as explained below. In all other respects the project was completed at a total cost of \$84,130.72, or about four-tenths of 1 per cent less than estimated.

By the terms of the contract sixteen months were allowed for completing the work. The time consumed amounted to nineteen and one-half months, an extension of the additional time being granted the contracting firm at its request.

The river was not frozen during the winter of 1900 and 1901.

The estimated and actual volumes and cost of excavation and its carriage are as follows:

	Estimated.	Actual.
Earth	4,414.00	25,252.96
Cobblestones	3,608.00	2,354.03
Soft rock	7,219.00	7,758.84
Hard rock	16,393.00	15,306.26
Totals	31,634.00	50,672.09
Towing below Jetty No. 150	22,000.00	14,889.59
Wheeling	15,000.00	18,071.55
Cost	\$80,299.10	\$79,691.05

The differences between the estimated and actual quantities of excavation given above are accounted for as follows:

(1) The estimate of quantities accompanying specifications is based on soundings and probings, the former being the water depths, the latter the depths to the rock through soft material, if any, overlying it.

¹ Omitted.

In classifying the proposed excavation below the rock line as determined by probings, from 60 to 80 per cent, depending on the locality, is assumed to be hard rock, the remainder soft rock, cobblestones and earth. The bed of the river between Richmond and the lower end of Richmond bar, $2\frac{1}{10}$ miles below the lower city line, through which the channel excavation is being carried, appears to consist generally of detached areas of granite and gneiss rock and fields of large bowlders, with the intervening spaces filled with soft rock, smaller granite and trap bowlders, granite and sandstone cobblestones, gravel and sand. The ancient rocky bed, where excavation has not been carried on, is usually overlaid to greater or less depths with cobblestones, above which are recent deposits of silt, sand, etc.

As the distribution of the above materials is not very uniform, and as there is no way of arriving at a correct classification of quantities until the work is done, even by making the most elaborate borings, those published in the specifications are stated as being approximate.

(2) While the work is in progress freshets occur and large volumes of silt and sand are sometimes deposited over areas that have been excavated, making reexcavations necessary, and when excavation is being made in sand it is sometimes carried below the required depth by the contractor; or, if the sand is very fine, large quantities flow in from the sides of the cut. On account of the above the estimated volume of earth excavation is increased.

Under the recent contract the rock excavation was 6.6 per cent less than estimated. The excess of the other materials in the aggregate, 130 per cent, resulted from deposits of sand by freshets at Goode rocks between Jetties 26 and $28\frac{1}{2}$, from over-depth excavation at Richmond bar and inflow of sand from the sides of cuts at both localities.

After the excavation at Goode rocks under the recent contract was completed to the required depth, an area of about 38,000 square feet between Jetties 26 and $28\frac{1}{2}$ was filled back during excessive freshets in April, 1901, to an average depth of about 4 feet. The above deposit occurred at the lower end of a shore bar on the convex side of the bend at Goode rocks between Jetties 20 and $28\frac{1}{2}$, formed by the oblique direction of the channel approaching Goode rocks from above.

The above experience goes to show that unless existing conditions of flow are changed, no widening of the channel at Goode rocks, by excavating through the bar, in line with the general project approved July 5, 1884, will be permanent.

EXCAVATING CHANNEL.

In conducting channel excavation in hard rock, it was generally necessary to repeat both operations of blasting and dredging three or four times over the same area before the desired depth was attained at all points. In dredging material broken up by the first two or three blastings, the dredge was provided with a scoop or dipper; in the final clearing of the channel, with a clam-shell bucket. The use of the latter device was begun January 4, 1901, by which date the heaviest part of the work was completed. Large masses of rock weighing from 2 to 7 tons and too large or heavy for either kind of dredge bucket to handle, were removed by hoisting with a chain from the dredge boom.

DRILLING AND BLASTING.

The method of drilling and blasting was the same as that pursued in 1899 and 1900, and is fully described in the report of operations for the latter year.

After generally securing the desired depth by heavy blasting with the explosive in drilled holes, charges of dynamite laid on the bottom of the channel were fired to break and scatter the material composing detached areas still remaining above the required depth. All work of the above character was done after January 4, 1901, by the drill and dredge working in conjunction.

A description of the methods of collecting data and the results of their study to determine the depth effect of blasting and the empirical formulæ deduced therefrom, suggested for regulating the depth of excavation in hard rock, are contained in Appendix A.

Exhibit A, subjoined, shows the details of drilling and blasting for the year.

EXHIBIT A.—*Details of drilling and blasting for excavating channel, James River, Virginia, during fiscal year ending June 30, 1901.*

ROCKETTS REEF, BETWEEN LOWER CITY LINE OF RICHMOND AND JETTY B.

No. of cut.	Period.	Number of blast holes.		Average depth of holes.		Dynamite.	Elevation bottom of holes.	Area blasted.	Time, approximate.
		Drilled.	Fired.	Loose material.	Hard rock.				
				<i>Feet.</i>	<i>Feet.</i>	<i>Pounds.</i>	<i>Feet.</i>	<i>Sq. feet.</i>	<i>Hours.</i>
3 and 4a.....	July 2-12, 1900	218	217	1.7	3.1	1,918	21.1	9,330	100.5
1, 2, 3, and 4f.....	Nov. 12-23, 1900	113	111	1.7	2.1	870	21.2	.....	96.8
3 and 4k.....	Jan. 4-12, 1901	5	5	.0	4	53	21.6	.....	12.7
		336	333	1.7	2.8	2,841	21.1	.....	210
Reported for fiscal year ending June 30, 1900.....		1,247	1,232	1.6	4.7	13,544.1	21.8	.....	829.3
Total for contract.....		1,583	1,565	1.6	4.3	16,385.1	21.7	.....	1,039.3

GOODE ROCKS SECTION.

4, 5, and 6b.....	Aug. 11-31, 1900	343	342	2.5	4.5	4,061	21.6	10,000	194.3
5 and 6c.....	Sept. 1-29, 1900	322	320	2.5	4.5	3,815.5	21.3	9,925	239.5
5 and 6.....	Oct. 1-13, 1900	194	192	4.4	3.3	1,643.5	21.5	10,950	124.1
5 and 6d.....	Oct. 24-31, 1900	78	71	2.5	1.5	416	20.8	.....	67.1
5 and 6g.....	Nov. 1-12, 1900	107	106	2.2	1.8	694.5	21.3	.....	87.2
5 and 6j.....	Dec. 1-10, 1900	14	14	1.8	2.3	134	21.7	.....	21.4
4k.....	Jan. 23-29, 1901	14	14	.2	3.7	140	21.8	.....	16
4, 5, and 6k.....	Feb. 4-28, 1901	152	151	.4	3.4	1,431	21.3	.....	177.4
1, 2, 4, 5, and 6k.....	Mar. 1-28, 1901	65	63	.6	2.9	610.3	21.2	.....	82.2
2 and 4k.....	Apr. 10-29, 1901	13	12	.0	4	129	21.5	.....	26
		1,302	1,285	2.3	3.7	13,074.8	21.3	.....	1,035.2
Reported for fiscal year ending June 30, 1900.....		964	945	2	4.4	11,148.8	21.7	.....	702.1
Total for contract.....		2,266	2,230	2.2	4	24,223.6	21.5	.....	1,737.3

RICHMOND BAR.

1.....	July 13-31, 1900	325	320	1.4	3.2	3,007.5	21.4	10,560	176.5
1.....	Aug. 1-11, 1900	179	176	1	4.3	2,037.3	21.2	5,500	102.3
1 and 2e.....	Oct. 15-24, 1900	91	91	1.9	.9	491.5	20.3	.....	79.7
1 and 2h.....	Nov. 26-30, 1900	20	20	1.2	2	144	21	.....	26
1 and 2k.....	Mar. 20-22, 1901	15	15	.6	1.6	103.5	20.3	.....	22.8
1 and 2k.....	May 2-16, 1901	18	18	.0	2.3	131	20	.....	30
		648	640	1.3	3.1	5,914.8	21.1	.....	437.3
Reported for fiscal year ending June 30, 1900.....		170	170	1.3	3	1,331	21.4	.....	111.5
Total for contract.....		818	810	1.3	3.1	7,245.8	21.2	.....	548.8
Aggregate.....		2,286	2,258	1.9	3.4	21,830.6	21.2	.....	1,682.5
Aggregate reported for fiscal year ending June 30, 1900.....		2,381	2,347	1.7	4.4	26,022.9	21.7	.....	1,642.9
Aggregate for contract.....		4,667	4,605	1.8	3.9	47,853.5	21.5	.....	3,325.4

a Second blasting of cut 3, 693 square feet.

b Second blasting of cuts 4 and 5, 297 square feet.

c Second blasting of cut 5, 429 square feet.

d Second blasting of cuts 5 and 6, 3,292 square feet.

e Second blasting; area, 3,003 square feet.

f Second blasting of cut 4, 1,749 square feet. Third blasting, cuts 1, 2, and 3, 1,980 square feet.

g Second blasting of cut 6, 3,531 square feet. Third blasting of cut 5, 264 square feet.

h Third blasting, 627 square feet.

j Second blasting, 462 square feet.

k Final blasting of isolated points.

Of the dynamite shown by the record as fired in blast holes during the contract, viz, 47,853 pounds, all but 321 pounds, which were used for making 58 blasts in soft decomposed rock, was expended in excavating where, according to information gotten from drilling the holes, there was more or less hard rock. The charges were proportioned approximately to the depth of hole in hard rock.

A part of the energy developed in blasting hard rock overlaid by other materials is expended in loosening the latter. As it is impracticable, however, to determine the proportion, the whole expenditure will have to be considered as for the former.

According to this view about 3.23 pounds of dynamite on an average blasted 1 cubic yard of rock; or, stated differently, 1 pound of the former blasted 0.309 cubic yards of the latter.

At Rocketts reef and Goode rocks the average quantities of hard rock blasted per pound of dynamite were somewhat greater than the average for the whole work, being 0.317 cubic yards for the former and 0.334 cubic yards for the latter, while for Richmond bar the quantity moved was 0.286 cubic yards per pound.

DREDGING.

About 82 per cent of the excavation was removed by a dipper or scoop bucket and 18 per cent by a clam shell, the former, as above explained, being employed for the heaviest part of the excavation, the latter, after this was accomplished, in removing from the floor of the cut detached areas slightly above the required depth.

The number of days lost through various causes in excavating the channel, from the beginning to the completion of the work, are as follows: Freshets, forty-four days; ice, nine and one-fourth days; fogs, four days; waiting for scows to be unloaded, forty-four days.

The details of dredging are contained in Exhibit B.

EXHIBIT B.—*Details of dredging for channel excavation, James River, Virginia, during fiscal year ending June 30, 1901.*

ROCKETTS REEF, BETWEEN LOWER CITY LINE OF RICHMOND AND JETTY B.

No. of cut.	Period.	Cubic yards dredged.					Area.	Time approximate.
		Earth.	Cobble-stones.	Soft rock.	Hard rock.	Total.		
3 and 4a.....	July 19-31, 1900	81.74	42.59	291.90	823.93	1,240.16	<i>Sq. feet.</i> 24,735	<i>Hours.</i> 108
4.....	Aug. 1-24, 1900	242.51	19.12	754.89	973.85	1,990.37	20,355	122.8
1, 2, 3, and 4b.....	Dec. 13-31, 1900	66.32	14.89	103.02	398.99	583.22	86,125	101.3
1, 2, 3, and 4c.....	Jan. 4-22, 1901	106.04	36.29	77.34	309.28	528.95	.....	63.1
Total.....	.....	496.61	112.89	1,227.15	2,506.05	4,342.70	.....	395.2

GOODE ROCKS SECTIONS.

1 and 6.....	Sept. 13-29, 1900	248.81	34.57	124.54	834.94	1,242.86	8,790	121.7
6.....	Oct. 1-31, 1900	1,231.23	30.56	585.92	1,737.31	3,585.02	22,800	203.8
6.....	Nov. 1-8, 1900	1,613.76	38.07	12.53	52.95	1,717.31	4,000	33.2
1, 4, and 5d.....	Nov. 15-30, 1900	793.42	2.76	44.69	489.34	1,330.21	3,500	97.2
5 and 6e.....	Dec. 1-12, 1900	277.56	5.20	20.81	363.87	667.44	22,000	62.5
4 and 5f.....	Jan. 23-31, 1901	784.31	.....	.....	73.47	857.78	13,450	62.5
4, 5, and 6g.....	Feb. 1-28, 1901	3,491.83	3.99	94.31	265.75	3,855.88	35,425	179
4, 5, and 6h.....	Mar. 1-30, 1901	1,482.29	.....	1.33	667.55	2,151.17	74,000	210.7
1, 2, and 4j.....	Apr. 4-29, 1901	162.82	.....	.....	199.49	362.31	.....	.....
1.....	Apr. 29-30, 1901	30.84	1.71	1.71	31.93	66.19	47,250	124.2
Total.....	.....	10,116.87	116.86	885.84	4,716.60	15,836.17	.....	1,093

RICHMOND BAR.

1 and 2k.....	July 1-19, 1900	992.38	312.13	479.61	323.91	2,108.03	34,450	69.3
1l.....	Aug. 17-31, 1900	745.63	175.67	356.68	413.60	1,691.48	22,625	89.1
1m.....	Sept. 1-13, 1900	802.87	135.17	374.08	448.65	1,760.77	23,725	83
1 and 2n.....	Nov. 8-15, 1900	98.39	25.41	80.74	132.83	337.37	24,739	44.7
1, 2, and 3o.....	May 1-31, 1901	650.21	57.03	11.03	355.64	1,053.91	64,000	173.1
1p.....	June 1-5, 1901	327.31	8.87	.....	6.15	342.33	.....	36.8
Total.....	.....	3,596.79	714.28	1,302.04	1,680.78	7,293.89	.....	496
Aggregate.....	.....	14,210.27	944.03	3,415.03	8,903.43	27,472.26	.....	1,984.2

a Cut 3, second dredging.

b Cut 4, second dredging; cuts 1, 2, and 3, third dredging.

c Dredge and drill working together.

d Second dredging.

e Cut 6, second dredging; cut 5, third dredging.

f Cuts 4 and 5, second dredging; part of cut 4, third dredging.

g Cut 6 and part of cut 5, second dredging; cut 4 and part of cut 5, third dredging.

h Third dredging; part of cut 6, second dredging.

i Third dredging; part of cut 4, fourth dredging.

k Cut 2, second dredging.

l Second dredging.

m Second dredging.

n Third dredging.

o Fourth dredging.

p Fifth dredging.

EXPENDITURE OF EXCAVATED MATERIAL.

On account of the large proportion of earth excavation considerable difficulty was experienced in finding a place for depositing it without wheeling, where it would not be washed back into the channel by waves from passing steamers. The greater part was placed between the training dike on the left bank and the adjacent island shore, between Jetties 52 and 56.

Exhibit C shows the disposition made of the excavation.

EXHIBIT C.—Quantities of material excavated from channel and deposited on dikes and jetties during fiscal year ending June 30, 1901.

Point of expenditure.	Earth.	Cobble- stones.	Soft rock.	Hard rock.	Total.	Wheeling.	Towage.
	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Miles.</i>
Rocketts Reef, Jetty B.....	7.09		37.34	158.93	203.36	147.12	
Richmond to Stearns dike:							
Jetty A.....			11.64	45.72	57.36	57.36	
Jetty 1.....			2.24	28.52	30.76	30.76	
Jetty 3.....			4.22	27.09	31.31	31.31	
Jetty 5.....	8.85		17.70	37.17	63.72	56.97	
Jetty 9.....	5.87		27.33	38.88	72.08	72.08	
Jetty 11.....	7.81		15.63	31.73	55.17	55.17	
Jetty 13.....	1.91		7.64	29.57	39.12	39.12	
Jetty 15.....				14.86	14.86	14.86	
Stearns dike to Goode Rocks:							
Jetty 16½.....				21.04	21.04		
Jetty 17.....	2.19		11.24	15.35	28.78	28.78	
Jetty 18.....				15.14	15.14		
Jetty 19.....	3.11		9.32	32.20	44.63	44.63	
Jetty 20.....	25.26		8.42	41.64	79.84	71.13	
Jetty 21.....	12.59	10.23	13.39	30.21	66.42	42.83	
Jetty 22.....				9.20	9.20		
Jetty 23.....	9.97	8.86	7.89	30.23	56.95	39.87	
Jetty 25.....				18.72	18.72	9.43	
Jetty 27.....	15.91		10.61	22.19	48.71	39.42	
Goode Rocks section:							
Jetty 28.....	14.78	11.08	40.65	50.90	117.41	97.97	
Jetty 29.....				19.49	19.49	3.11	
Jetty 30.....	5.43		10.87	23.06	39.36		
Jetty 32.....	36.66		72.04	60.25	168.95	65.01	
Richmond bar:							
Jetty 34.....	41.68		88.29	122.22	252.19	175.99	
Jetty 36.....	77.63	14.50	74.71	69.49	236.33	82.80	
Jetty 37.....	99.00	10.95	161.85	86.44	358.24	195.32	
Jetty 38.....	137.98	18.87	111.37	110.84	379.06	141.22	
Jetty 39.....	8.88			79.06	87.94	54.55	
Jetty 40.....	143.43	23.76	99.15	49.15	315.49	95.75	
Jetty 41.....	26.88	6.15		90.86	123.89	94.37	
Jetty 43.....	15.71		10.10	110.98	136.79	53.38	
Jetty 43½.....				17.60	17.60		
Jetty 44.....	116.66	34.59	91.17	92.82	335.24	64.55	
Jetty 45.....	22.46		82.52	117.77	222.75	151.70	
Jetty 46½.....	81.18	25.24	78.69	160.94	346.05	231.35	
Jetty 46¾.....	50.70	12.47	7.02	67.67	137.86	53.27	
Jetty 46¾.....	151.12	30.63	99.47	58.22	339.44	168.77	
Jetty 47.....	44.87	4.78	174.24	144.76	368.65	277.72	
Jetty 48.....	133.62	22.26	28.86	58.84	243.58	166.92	
Randolph Flats:							
Jetty 49.....	7.40	8.30	35.57	123.81	175.08	46.48	
Jetty 50.....	183.33	34.16	51.64	90.99	360.12	226.78	
Jetty 51.....	10.85	4.40	14.38	136.53	166.16	43.79	
Jetty 52.....	67.15	8.34	16.99	82.92	175.40	100.80	
Jetty 53.....			28.08	106.57	134.65	35.19	
Jetty 54.....	195.57	5.42			200.99	200.99	
Jetty 55.....	8.76		35.79	122.03	166.58	91.48	
Jetty 57.....	20.58		35.17	104.55	160.30	115.63	
Jetty 59.....	26.46		21.28	187.38	235.12	98.90	
Jetty 61.....	21.51		1.99	107.45	130.95	83.79	
Dike between Jetty 50 and Jetty 58.....	5,168.18	93.14	305.40	1,081.04	6,647.76	5,165.91	
Warwick Reach:							
Jetty 61½.....	97.69	1.53		150.55	249.77	189.73	
Jetty 63.....	161.47	7.15	12.43	106.64	287.69	232.57	
Jetty 67.....	118.29			69.37	187.66	134.45	
Jetty 71.....	14.37	10.05	18.77	63.70	106.89	51.53	
Jetty 75.....	32.88		21.74	42.52	97.14	74.25	
Jetty 77.....	69.80			118.53	188.33	104.03	
Jetty 78.....	104.28	6.46	4.48	45.17	160.39	115.22	
Jetty 79.....	234.39	8.60	14.68	214.44	472.11	321.42	
Jetty 80.....	51.68	17.47		52.78	121.93	44.21	
Jetty 81.....	87.13	28.17	89.02	136.63	340.95	264.79	
Jetty 82.....	57.65	5.36	2.85	109.54	175.40	46.49	
Jetty 83.....	702.49	14.45	23.00	178.93	918.87	310.66	

EXHIBIT C.—Quantities of material excavated from channel and deposited on dikes and jetties during fiscal year ending June 30, 1901—Continued.

Point of expenditure.	Earth.	Cobble-stones.	Soft rock.	Hard rock.	Total.	Wheeling.	Towage.
	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Miles.</i>
Warwick bar:							
Jetty 85.....	1, 221.62	41.53	6.31	43.66	1, 313.12	216.88	.....
Jetty 87.....	562.92	18.23	37.66	134.24	733.05	100.68	.....
Jetty 89.....	218.72	2.46	5.33	67.10	293.61	81.97	.....
Jetty 91.....	63.26	.....	.....	25.62	88.88	67.07	.....
Jetty 93.....	263.45	.....	.....	12.82	276.27	49.55	.....
Jetty 95.....	343.84	.....	.....	46.72	390.56	100.42	.....
Jetty 97.....	92.73	8.98	2.16	.....	103.87	24.92	.....
Falling Creek section:							
Jetty 112.....	11.39	.....	55.62	59.40	126.41	30.29	.....
Jetty 113.....	16.24	.....	48.71	8.52	73.47	.....	.....
Jetty 114.....	2.55	.....	5.09	37.02	44.66	37.13	.....
Jetty 115.....	37.84	.....	182.47	70.34	290.65	60.24	.....
Jetty 116.....	25.34	15.38	52.84	219.54	313.10	91.93	.....
Jetty 117.....	34.22	22.62	63.57	119.86	241.27	112.98	.....
Jetty 118.....	10.14	.....	97.14	100.98	208.26	97.25	.....
Falling Creek to Drewry Bluff section:							
Jetty 119.....	.....	.....	41.35	276.14	317.49	38.51	.....
Jetty 120.....	57.54	6.96	127.02	148.52	340.04	106.45	.....
Jetty 124.....	162.70	35.22	122.65	57.60	378.17	144.02	.....
Jetty 128.....	168.44	45.22	87.30	25.31	326.27	105.31	.....
Jetty 132.....	82.38	23.24	34.91	41.76	182.29	104.90	.....
Jetty 134.....	71.33	18.94	20.01	40.67	150.95	86.17	.....
Jetty 138.....	78.69	13.67	28.64	43.77	164.77	50.59	.....
Jetty 142.....	170.96	61.93	40.80	75.38	349.07	114.97	.....
Jetty 146.....	164.42	67.62	44.70	41.20	317.94	144.59	.....
Jetty 147.....	.....	.....	.....	5.11	5.11	.....	.....
Jetty 150.....	49.97	43.90	15.89	17.87	127.63	115.50	.....
Wards Reach:							
Jetty 209.....	74.31	.....	.....	28.99	103.30	.....	1.13
Jetty 210.....	47.43	4.40	13.18	52.36	117.37	29.96	1.13
Jetty 211.....	512.53	.....	4.58	78.62	595.73	177.64	1.21
Jetty 212.....	10.50	.....	.....	55.09	65.59	27.62	1.21
Jetty 213.....	25.62	.....	.....	24.35	49.97	.....	1.29
Jetty 214.....	33.47	.....	.....	40.67	74.14	.....	1.29
Willis Reach:							
Jetty 253.....	27.15	1.47	1.54	47.05	77.21	15.42	2.61
Jetty 256.....	47.27	7.52	42.45	178.03	275.27	77.28	2.71
Ferry Reach:							
Jetty 301.....	92.43	.....	.....	54.81	147.24	108.23	4.20
Jetty 303.....	125.00	.....	1.34	77.98	204.32	79.59	4.30
Jetty 305.....	107.74	.....	.....	47.76	155.50	.....	4.39
Jetty 307.....	32.30	.....	.....	91.88	124.18	.....	4.48
Deep Bottom:							
Jetty 551.....	30.84	1.71	1.71	46.94	81.20	.....	10.99
Jetty 553.....	45.05	.....	.....	39.77	84.82	.....	11.11
Jetty 554.....	29.65	.....	.....	39.84	69.49	.....	11.11
Curles Neck:							
Jetty 619.....	5.31	1.00	21.35	64.95	92.61	44.91	14.25
Jetty 621.....	165.87	5.20	20.81	213.86	405.74	130.00	14.35
Jetty 623.....	126.45	4.92	4.92	190.06	326.35	80.11	14.44
Jetty 625.....	9.53	.....	33.10	154.49	197.12	49.64	14.55
Total.....	14, 210.28	944.01	3, 415.02	8, 919.47	27, 487.78	13, 946.40	.....

The larger proportion of the hard-rock excavation, as placed by the dredge on the carrying scows, is in masses weighing from 500 pounds to one or more tons, and too large for casting on the jetties by hand. It appears to have been generally the custom in conducting the improvement to dump the largest masses at the stream ends of the jetties, where there is a probability of their sometimes rolling farther into the channel than desirable. This practice was discontinued during the past year.

The general use of such large stones for revetting the James River jetties is, as a rule, wasteful, as it is impracticable with the means available to lay them in close order. If reduced to the size of about "one-man stone" the same volume would reach farther by covering a larger surface, and by being of such sizes as to be readily handled could be placed so as to protect the jetties more effectively.

It appears that during the progress of the improvement the output of hard rock has never been sufficient to completely revet all the jetties, and in consequence there are many in which the timber, impaired by age, is exposed to ice movements and freshets. To reduce renewals of timber to a minimum it is very desirable to complete its protection. This can be greatly expedited by providing in future contracts for reducing to suitable sizes for economical handling the larger masses of stone after being removed from the excavation.

CONDITION OF THE CHANNEL.

No examination of the channel was made during the year, except where improvements were in progress. It is not probable that any marked changes have occurred at any other points.

No examination of the shoals in the lower reaches of the river has been made for five or six years. The chart of Dancing Point shoal of 1895 shows depths slightly under 18 feet, while those of the chart of 1896 are about a foot greater. It may be therefore stated that, with the following exceptions, the low-water dimensions of the channel between Richmond and the mouth of the river are 100 feet wide and upwards by 18 feet deep and upwards, viz.:

Between Jetty B and Goode Rocks the width is reduced for an 18-foot depth at several points by shoals to about 25 to 75 feet, and by a number of detached rocks to 60 to 75 feet for a depth of 16½ feet. On Warwick Reach the depth is 17½ feet.

Allowing 1 foot for increased draft of vessels, moving at moderate speeds, it appears that the drafts to which vessels can be loaded and pass through the present channel with perfect safety at mean low water are, for the reach between the mouth of the river and Warwick Reach 16.7 feet, and for that between the foot of Warwick Reach and the lower city line of Richmond 15½ feet.

According to a register of vessels passing the United States engineer gauge, two drawing 15½ feet arrived at Richmond during the past fiscal year, but none of greater draft. There were many arrivals and departures of vessels drawing from 12½ to 15 feet.

It appears also from the register that the times of arrival at and departure from Richmond of steam vessels drawing 10 feet and upward are arranged to occur nearly always when the tidal stage is such as not to make the immersion of the ship's keel exceed 10 to 11 feet below mean low water. In rare instances is the immersion below that plane as great as 12 feet.

On the afternoon of July 16, 1900, the steamship *S. T. Morgan*, of Richmond, Va., of 1,836 tons burden, said to be drawing about 16 feet, ran hard aground in the Goode rocks section on account of the improper placing of a black spar buoy. The ship was gotten afloat without sustaining serious damage.

On January 6, 1901, at about 6.30 a. m., the stage being 3.3 feet above low tide, the steamship *Richmond*, of New York City, of a gross tonnage of 1,437 tons, with a maximum keel immersion of about 10 feet below low tide, struck an obstruction outside of the channel at Graveyard reach and was beached to prevent its sinking. The accident resulted from attempting to run the ship while it was too dark to see the channel. The ship was temporarily repaired and cleared for the Newport News dry dock January 10.

In carrying on dredging four buoy anchors, from which the spars had at some previous time been broken, were removed from the channel. These anchors, consisting of flat stones weighing nearly a ton, carrying a large eyebolt projecting about 15 inches above the bottom of the channel, constitute formidable obstructions.

TIDES AND FRESHETS.

A compilation of the normal low-tide day readings of the James River United States engineer gauge staff opposite Richmond, Va., covering the period between March 1, 1894, and August 31, 1900, was made for the purpose of determining the plane of mean low water and the proportionate periods of normal low tides of different stages. The night tides are omitted from the observations, as no regular night record was kept of staff readings or of freshets and wind. The continuity of the observations was broken on account of interruptions from suspension of work, the river being frozen or in freshet, and other causes. The total number of observations for the period is 1,767 out of a possible 2,375. There are 1,153 observations apparently unaffected by winds or freshets, the average of which establishes the plane of mean low water at an elevation of -0.234 foot on the gauge staff. The extremes are $+1.7$ and -1.5 . Sixty-eight per cent of the observations fall below the assumed zero of the gauge.

In volume 2, page 1,011 of the Annual Report of the Chief of Engineers of 1896, the plane of mean low water at Richmond, derived from 591 observations, is given as -0.27 foot. From these observations were excluded, regardless of cause, all gauge readings 1.4 feet above or below the assumed zero of the gauge.

It appears from the preceding that depths less than 18.234 feet below the gauge zero, attained in carrying on the improvement in the vicinity of Richmond, Va., fall short of the depth now sought, of 18 feet at mean low water.

Plate III¹ shows the proportionate periods of different stages of normal low water and the extent to which the efficiency of the improvement is effected by them.

¹Omitted.

The United States engineer tide gauge used at Richmond, Va., for recording tides is an old-style Saxton gauge installed about twenty-three years ago. As the times of tides given by its maregrams are not correct, a method for their correction was introduced during the past year. A description of the method is contained in Appendix B.

The stage of water during the year was above the normal tidal range on account of freshets an aggregate of fifty days. A list of freshets is subjoined.

James River freshets, observed at Richmond, Va., from June 30, 1900, to June 30, 1901.

Date.	Elevation of crest above zero of gauge.	Freshet period.
1900.	<i>Fect.</i>	<i>Hours.</i>
October 26	6	42.5
November 28	13	67
December 5	6.85	80.5
1901.		
January 13	8.6	106.5
March 13	6.7	53.5
April 4	11	156
April 15	12.2	129
April 22	15.7	198
May 24	21.1	226
June 17	13.15	136.5

MISCELLANEOUS.

In December, 1900, 37 cross sections were sounded at Goode rocks, and in March, 1901, 27 sections, to obtain data as to cause of bar formation at that locality.

In May, 1901, 17 sections between Allmond Creek and Warwick bar were sounded, to obtain data for the preparation of projects.

A project was submitted in June, 1901, in line with the general project approved July 5, 1884, for the expenditure of the balance of the appropriation of March 3, 1899.

Contours of cut 4, Rocketts reef, were located by 4,000 soundings, and of cuts 1 and 2, Richmond bar, by 15,000 soundings, all spaced $2\frac{1}{2}$ by $2\frac{3}{4}$ feet, to furnish data for determining the depth effect of blasting.

The slope between Mayo Bridge and the United States engineer tide gauge opposite Richmond, the distance between which is 1.25 miles, was observed on May 24, 1901, when the stage was 21.1 feet on the gauge, and found to be 1.4 feet.

An auction sale of condemned United States engineer property was held on February 5, 1901.

A report was submitted in October, 1900, on application of G. M. Gaubert, to construct a landing in James River near the mouth of Shockoe Creek.

The steam tug *Robert Leslie* was under steam twenty-four days during the year.

The force employed under this office during the period of active field operations consisted of one assistant, one inspector, one draftsman, one recorder, three sub-inspectors for a part of the time and two for the remainder, two watchmen, and two laborers. On the completion of the contract for improving the channel the two sub-inspectors were transferred to the work of protecting Jamestown Island, Virginia.

Very respectfully, your obedient servant,

SAML. H. YONGE,
Assistant Engineer.

Lieutenant-Colonel CHAS. J. ALLEN,
Corps of Engineers, U. S. A.

APPENDIX A.

RELATION BETWEEN DEPTH OF BLAST HOLE AND DEPTH EFFECT IN EXCAVATING HARD ROCK FOR THE WORK OF IMPROVING JAMES RIVER, VIRGINIA.

In the annual report for 1900, Volume II, page 1731, a brief description was published of the methods employed on the work of improving James River, Virginia, for collecting and studying data pertaining to blasting for the purpose of determining the depth effect in excavating hard rock with approximately uniform charges of 75 per cent dynamite per unit of hole depth. During the year's operations just completed this subject was investigated further, with some improvement in the method of collecting data suggested by the experience of the former year.

The hard rock comprises several varieties of granite and gneiss of varying degrees of hardness and density.

The blast holes were placed at intervals of about $5\frac{1}{2}$ feet on approximately parallel lines 6 feet apart, normal to the long axis of the cut. The diameter of the holes was about $3\frac{1}{2}$ inches. The dynamite, No. 1 (75 per cent nitroglycerin), was furnished in cartridges about $2\frac{1}{2}$ inches diameter, and the charge proportioned approximately to the depth of hole in the hard rock in the ratios of about 2.23 to 2.74 pounds per foot of hole, and filling from 65 to 80 per cent of its depth. The part of the hole above the cartridge was filled loosely with coarse sand and fine gravel. The holes were fired simultaneously in groups by means of a battery.

The positions of the holes were determined by shore ranges and bases. The depth of water and thickness of soft material, if any, overlying the hard rock were ascertained for each hole and recorded; also the total depth of hole and charge of explosive.

On completing the blasting of a cut, the loosened material was removed by the dredge, after which the contours of the bottom of the excavated area were determined by soundings spaced $2\frac{1}{2}$ by $2\frac{3}{4}$ feet. The soundings being platted in connection with the blast holes, a tabulation was made of the hole depths and resulting excavation at the holes, both in hard rock. By plating the above data with reference to rectangular coordinates, it is apparent that the relation between depth of hole and the excavating depth effect of its charge of explosive is not direct, and would be expressed graphically by some conic. The amount of flexure for the limited length of arc necessary, however, is so slight that it seems almost immaterial as to the curve employed, with the probability of that of the parabola with its axis horizontal being best adapted to fulfilling the purpose. That curve, therefore, expressed by the equation $x = Ay^2 + By + C$ was used in the investigation. In the above expression x = average depth of resulting excavation within a rectangle of 5 by $6\frac{1}{2}$ feet around the blast hole in hard rock, y = depth of blast hole, both in feet, and A, B, and C constants whose values are obtained as explained below and substituted in the above expression. As the depths of excavation can not always be measured under water with accuracy, those in the computation are taken only to the nearest tenth of a foot. To introduce the weight of each individual observation in deducing a general expression covering all observations, the method of Least Squares is employed, as follows:

An equation is formed for each observation by inserting in the expression $x = Ay^2 + By + C$ the values of x and y ; e. g., for $x = 3.5$ and $y = 5.5$, the observation equation becomes $3.5 = 30.25 A + 5.5 B + C$.

From the observation equations, normal equations are formed for A, B, and C; that in A by multiplying all terms in each of the former by the coefficient of A in the same equation and adding all like multiplied terms; the same process is employed in forming the normals in B and C. As the coefficient of C is unity, the sums of the like terms of the observation equations are the terms of its normal equation. From the normal equations the values of A, B, and C are found by algebraic methods.

The above process was applied to data representing two different conditions, viz., in "rock bare" and "rock overlaid by earth, sand, decomposed rock, etc." to a depth of from 0.2 foot to 3.5 feet, or an average of 1.6 feet. Nearly all of the blasting is carried on under the second condition.

Seventy-seven observations were employed in deducing the formula resulting from the first condition, viz:

$$x = 0.05717979y^2 + 0.16212241y - 0.032217.$$

For the second condition, involving 195 observations, the formula is

$$x = 0.08002172y^2 - 0.14039498y + 0.62712.$$

Dropping decimals of the coefficients beyond the third place, the following tables are constructed:

Table computed from the formulæ showing the average results of blasting under the two conditions.

Depth of hole in hard rock.	Resulting excavation in hard rock.	
	Not overlaid by soft material.	Overlaid by soft material.
<i>Fect.</i>	<i>Fect.</i>	<i>Fect.</i>
3	0.97	0.93
4	1.53	1.35
5	2.21	1.93
6	3.00	2.67
7	3.90	3.57

The average charge of dynamite used for the 77 observations representing the first condition was 2.43 pounds per lineal foot of blast hole, filling about 71 per cent of the hole; that for the series of 195 observations, representing the second condition, was 2.27 pounds, filling about 66 per cent. The charge was therefore 7 per cent greater for the former than the latter and its excavating effect 10 per cent greater. It is probable also that the greater excavating effect in rock not overlaid is in a measure the result of that condition.

As the only restriction placed on the contractor in blasting was that the blast holes should not be carried lower than 22 feet below mean low water, data based on experiments conducted in a systematic manner are not available. The formulæ deduced will not always give the exact results desired. It is believed, however, that the employment of either for this particular work would prove valuable by reducing both excessive and deficient excavation resulting from the blast holes often being made either too deep or too shallow, the former diminishing the volume of excavation and cost, the latter the time of doing the work by making it unnecessary to repeat the excavating process over the same area so often—on this work, usually four times.

The formulæ are an improvement over that deduced from the observations of 1899 and 1900, inasmuch as the number and scope of the observations from which they are derived are greater and were more skillfully made.

The tables cover a range of about 1 to about 4 feet of excavation in hard rock, which limits include nearly all of the excavation to be made on this work.

APPENDIX B.

METHOD OF CORRECTING TIME RECORD OF MAREGRAMS OF OLD-STYLE SAXTON SELF-REGISTERING TIDE GAUGE.

In using the old-style Saxton self-registering tide gauge there are usually discrepancies between the times shown by the clock and those arrived at by scaling between right lines drawn between the punctures made on the edges of the maregram by the metal points at the ends of the middle roller or cylinder. The discrepancies are obviously errors of the maregram record and result from eccentricity of motion of the middle roller or of the paper. As the roller makes one revolution for twelve hours of the clock, the errors are not cumulative for a longer period. By the following simple method this error is eliminated and an agreement between the clock and maregram times obtained. At Richmond its application is principally for ascertaining times of night tides for which the observing of staff readings is inconvenient.

The surface of the middle roller is marked by letters A, B, etc., at each metal point used for making the half-hour punctures on the maregram, the same letter being used for each pair of opposite points. The clock being set in motion, as the roller revolves letters corresponding to those on the roller are marked on the paper and fine right lines drawn in pencil across the paper between each pair of points; e. g., A to A, A' to A', B to B, etc., and the clock times recorded on the lines. This is kept up for several days so as to obtain several sets of observations, each covering a complete revolution of the roller. The spaces between the right lines on the maregram are then carefully measured with a time scale and the average of the periods thus scaled for each space between contiguous lines compared with the average period recorded by the clock for the same space. The time of the maregram as scaled is then compared with its time as furnished by the clock and a table of corrections prepared, by applying which the correct clock time for any part of the maregram can be known. The lettering on the roller is preserved and similar letters occasionally marked on the maregram, e. g., once a day, while in process of making, at the punctures corresponding to the metal points by which they are made. In this manner any part of the maregram can be identified with the corresponding part of the roller on which it was drawn, and its time errors corrected.

To convey an idea of the extent of the errors of the maregram times and to furnish a form for table of corrections, the following, used for correcting the maregram times of the tide gauge employed on James River at Richmond, Va., is presented. The corrections were derived from the average of six days' observations (six revolutions of the roller). On account probably of some lost motion between the roller and the clock, which has not been located, there remains uneliminated a slight error of 0.3 minute. This, however, is within the limits of observation of the apparatus, and too small to impair the results.

In explanation of the table, the letters A, A', etc., represent the punctures in the maregram at which the half-hour lines are drawn across the sheet. The figures indicate corrections in minutes and tenths. The correction for the time of a tide falling on or near any line, e. g., J'-J', the clock time having been observed at or near the line E'-E', or five hours previous, is + nine minutes, and gives the time interval five hours nine minutes, instead of five hours.

Correction for reducing manegram to clock times for Saxton's self-registering tide gauge U. S. E., No. 33, James River, Virginia.

	A.	A'.	B.	B'.	C.	C'.	D.	D'.	E.	E'.	F.	F'.	G.	G'.	H.	H'.	I.	I'.	J.	J'.	K.	K'.	L.	L'.
A to.....	0.0	-0.3	-1.6	-2.4	-3.7	-4.5	-5.8	-6.1	-6.9	-7.2	-7.0	-5.8	-5.1	-3.4	-1.7	0.0	+0.7	+1.4	+1.6	+1.8	+1.5	+1.7	+1.4	+1.1
A' to.....	+0.6	0.0	-1.3	-2.1	-3.4	-4.2	-5.5	-5.8	-6.6	-6.9	-6.7	-5.5	-4.8	-3.1	-1.4	+0.3	+1.0	+1.7	+1.9	+2.1	+1.8	+2.0	+1.7	+1.4
B to.....	+1.9	+1.6	0.0	-0.8	-2.1	-2.9	-4.2	-4.5	-5.3	-5.6	-5.4	-4.2	-3.5	-1.8	-0.1	+1.6	+2.3	+3.0	+3.2	+3.4	+3.1	+3.3	+3.0	+2.7
B' to.....	+2.7	+2.4	+1.1	0.0	-1.3	-2.1	-3.4	-3.7	-4.5	-4.8	-4.6	-3.4	-2.7	-1.0	+0.7	+2.4	+3.1	+3.8	+4.0	+4.2	+3.9	+4.1	+3.8	+3.5
C to.....	+4.4	+4.8	+3.7	+2.4	0.0	0.0	-1.3	-2.4	-3.2	-3.5	-3.3	-2.1	-1.4	-0.3	+2.0	+3.7	+4.4	+5.1	+5.3	+5.5	+5.2	+5.4	+5.1	+4.8
C' to.....	+6.1	+5.8	+4.5	+3.2	+1.9	+1.6	0.0	0.0	-1.1	-1.4	-1.2	0.0	+0.7	+1.1	+2.8	+4.5	+5.2	+5.9	+6.1	+6.3	+6.0	+6.2	+5.9	+5.6
D to.....	+7.2	+7.2	+6.1	+4.8	+3.7	+2.4	+1.9	0.0	-0.8	0.0	0.0	+0.3	+1.2	+2.7	+4.4	+6.1	+6.8	+7.5	+7.7	+7.9	+7.6	+7.8	+7.5	+7.2
D' to.....	+8.8	+8.8	+7.7	+6.4	+5.3	+4.0	+3.5	+2.4	+1.4	0.0	-0.3	+1.1	+1.8	+3.5	+5.2	+6.9	+7.6	+8.3	+8.5	+8.7	+8.4	+8.6	+8.3	+8.0
E to.....	+7.5	+7.2	+5.9	+4.6	+3.5	+2.0	+1.7	+1.4	+0.6	0.0	+0.2	+1.1	+1.8	+3.8	+5.5	+7.2	+7.9	+8.6	+8.8	+9.0	+8.7	+8.9	+8.6	+8.3
E' to.....	+7.3	+7.0	+5.7	+4.9	+3.6	+2.0	+1.5	+1.2	+0.4	+0.1	0.0	+1.2	+2.1	+3.6	+5.3	+7.0	+7.7	+8.4	+8.6	+8.8	+8.5	+8.7	+8.4	+8.1
F to.....	+6.1	+5.8	+4.5	+3.7	+2.4	+1.9	+1.5	0.0	-0.8	0.0	-0.9	0.0	+0.7	+2.4	+4.1	+5.8	+6.5	+7.2	+7.4	+7.6	+7.3	+7.5	+7.2	+6.9
F' to.....	+5.4	+5.1	+3.8	+3.0	+1.7	+1.3	+0.9	0.0	-1.5	-1.8	-1.6	-0.4	0.0	+1.7	+3.4	+5.1	+5.8	+6.5	+6.7	+6.9	+6.6	+6.8	+6.5	+6.2
G to.....	+3.7	+3.4	+2.1	+1.3	0.0	-0.3	-2.1	-2.4	-3.2	-3.5	-3.3	-2.1	-1.4	0.0	+1.7	+3.4	+4.1	+4.8	+5.0	+5.2	+4.9	+5.1	+4.8	+4.5
G' to.....	+2.9	+2.6	+1.3	+0.4	-1.7	-2.5	-3.8	-4.1	-4.9	-5.2	-5.0	-3.8	-3.1	-1.4	-1.4	+1.7	+2.4	+3.1	+3.3	+3.5	+3.2	+3.4	+3.1	+2.8
H to.....	+0.3	0.0	-1.3	-2.1	-3.4	-4.2	-5.5	-5.8	-6.6	-6.9	-6.7	-5.5	-4.8	-3.1	-1.4	+0.3	+1.0	+1.7	+1.9	+2.1	+1.8	+2.0	+1.7	+1.4
H' to.....	-0.4	-0.7	-2.0	-2.8	-4.1	-4.9	-6.2	-6.5	-7.3	-7.6	-7.4	-6.2	-5.5	-3.8	-2.1	-0.4	0.0	+0.7	+0.9	+1.1	+0.8	+1.0	+0.7	+0.4
I to.....	-1.3	-1.6	-2.9	-3.7	-5.0	-5.8	-7.1	-7.4	-8.2	-8.5	-8.3	-7.1	-6.4	-4.7	-3.0	-1.3	-0.6	0.0	+0.2	+0.4	+0.1	+0.3	0.0	-0.3
I' to.....	-1.1	-1.4	-2.7	-3.5	-4.8	-5.6	-6.9	-7.2	-8.0	-8.3	-8.1	-6.9	-6.2	-4.5	-2.8	-1.1	-0.4	0.0	+0.1	+0.3	+0.0	+0.1	0.0	-0.7
J to.....	-1.3	-1.6	-2.9	-3.7	-5.0	-5.8	-7.1	-7.4	-8.2	-8.5	-8.3	-7.1	-6.4	-4.7	-3.0	-1.3	-0.6	0.0	+0.1	+0.3	+0.0	+0.1	0.0	-0.7
J' to.....	-1.1	-1.4	-2.7	-3.5	-4.8	-5.6	-6.9	-7.2	-8.0	-8.3	-8.1	-6.9	-6.2	-4.5	-2.8	-1.1	-0.4	0.0	+0.1	+0.3	+0.0	+0.1	0.0	-0.7
K to.....	-1.2	-1.5	-2.8	-3.6	-4.9	-5.7	-7.0	-7.3	-8.1	-8.4	-8.2	-7.0	-6.3	-4.6	-2.9	-1.2	-0.5	+0.2	+0.4	+0.6	+0.1	+0.2	0.0	-0.4
K' to.....	-1.4	-1.7	-3.0	-3.8	-5.1	-5.9	-7.2	-7.5	-8.3	-8.6	-8.4	-7.2	-6.5	-4.8	-3.1	-1.4	-0.7	0.0	+0.2	+0.4	+0.1	+0.2	0.0	-0.6
L to.....	-1.1	-1.4	-2.7	-3.5	-4.8	-5.6	-6.9	-7.2	-8.0	-8.3	-8.1	-6.9	-6.2	-4.5	-2.8	-1.1	-0.4	0.0	+0.2	+0.4	+0.1	+0.2	0.0	-0.3
L' to.....	-0.8	-1.1	-2.4	-3.2	-4.5	-5.3	-6.6	-6.9	-7.7	-8.0	-7.8	-6.6	-5.9	-4.2	-2.5	-0.8	-0.1	+0.6	+0.8	+1.0	+0.7	+0.9	+0.6	0.0

J 13.

PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

For full historical sketch please see pages 1736–1738, Appendix L, Annual Report of the Chief of Engineers for 1900.

A contract for the protection work of the bank was made December 6, 1900, with Lane Bros. & Co., of Esmont, Va., the work to commence on or before February 2, 1901, and to be completed on or before August 2, 1901.

The contract work began February 1, 1901, and was in progress at the close of the year; but a small portion of it has been completed.

Two appropriations have been made for this work—one in 1894 of \$10,000, and the other of \$15,000 in 1896. Neither appropriation was preceded, so far as records show, by any official report or estimate, and the wishes of Congress in regard to the extent of protection are not known.

With this is a report in detail, by Mr. S. H. Yonge, of the work of the fiscal year; also a tracing showing the plan of revetment.

Money statement.

July 1, 1900, balance unexpended	\$15,046.98
June 30, 1901, amount expended during fiscal year	581.43
July 1, 1901, balance unexpended	14,465.55
July 1, 1901, outstanding liabilities	185.00
July 1, 1901, balance available	14,280.55
July 1, 1901, amount covered by uncompleted contracts	14,000.00

CONTRACT IN FORCE.

With Lane Bros. & Co., of Esmont, Va., for constructing shore protection.

Amount: 1,350 linear feet.

Estimated amount of contract: \$14,000.

Date: December 6, 1900.

Approved: January 2, 1901.

Date for commencement: February 2, 1901.

Date for completion: August 2, 1901.

REPORT OF MR. SAMUEL H. YONGE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Richmond, Va., July 12, 1901.

COLONEL: I have the honor to submit the following report of operations pertaining to the work of protecting Jamestown Island from the encroachments of James River for the fiscal year ending June 30, 1901.

The part of the island where the principal erosion has occurred is the upper half mile of its western shore. The eroding bank consists principally of yellow clay underlain to depths of 10 to 30 feet by sand of varying fineness, mixed more or less with gravel, overlying a deep bed of dense blue clay. The bank generally has an elevation of about 8 feet above mean low water. It is intersected by three marshy sloughs, extending across the island from the main river to one of its arms, locally known as "Back River." The beds of the sloughs are slightly above low water. Back River occupies the lower $1\frac{1}{2}$ miles of the old channel of Powhatan Creek before

the creek was cut off by the washing away of the isthmus which formerly connected Jamestown peninsula at its upper end with the mainland. It now forms, in connection with the Thoroughfare below it, the boundary of the northeastern side of the island.

As there are no old charts available that are reliable and in sufficient detail, there is no means of arriving at the rate of erosion, except approximately.

According to an account written about the time of the first settlement in 1607, ships were then moored to trees at the upper end of what was then Jamestown peninsula, in 36 feet of water. The above depth is now found above the head of the island about 2,000 feet offshore. The area intervening between the island bank and the channel is flat and shoal. From this it is inferred that the erosion has been confined to the upper surface of the island, without any corresponding erosion and shifting of the thalweg toward the island. The erosion is produced by waves from passing steamers and high winds from N. W. by W. to S. W. by S., from which quarter they have an unobstructed sweep over from 3 to 8 miles of water. Great tides caused by winds from an easterly quarter, by saturating the banks, tend to increase the caving under wave action.

In 1894 \$10,000 was appropriated by act of Congress, with which, during the following year, about 2,500 feet of bank were graded to a slope 1 on 1½, and protected by a revetment formed of irregular pieces of granite and gneiss, generally weighing from 500 pounds to 2 tons, and four pile jetties, the latter partly masking the lower 1,000 feet of the revetment.

The condition of the work of 1895 at the time operations were begun under the existing contract in February, 1901, was approximately as follows:

Nearly all of the stone for the upper 1,500 feet of protected bank was undermined and lay from 2 to 25 feet in front of the bank. The work for the adjoining 1,000 feet of bank below was in better condition, about one-third of it being undermined, with a maximum encroachment of 5 feet. The undermining action resulted from waves penetrating through interstices between contiguous stones and washing away the bank against which they were laid. The jetties were in good condition.

Another appropriation of \$15,000 was made by act of Congress approved June 8, 1896, and a project prepared for its expenditure which was approved by the Chief of Engineers September 22, 1896. The above project was subsequently modified, the modification being approved by the Chief of Engineers April 26, 1897. In October and November, 1899, the work of 1895 and the bank were examined and borings made along the front exposed to erosion. From a study of the data thus obtained a new project was prepared, including a plan for meeting requirements imposed by existing physical conditions. The above project received the approval of the Chief of Engineers June 14, 1900. The work it embraces consists of removing the stone protection of 1895 for 1,800 linear feet of the northern and western banks at the head of the island and reducing it to backing, referred to in the description of plan following, and protecting by a new revetment the bank from in front of which the stone is taken.

At the prices of items contained in the accepted proposal, the appropriation will suffice for performing the required work for about 1,350 linear feet of bank, about 50 feet of which is to be on the northern and about 1,300 feet on the adjoining western shore.

The approved plan for the new revetment is briefly as follows:

"The bank to be graded between 1.2 feet below and 8.416 feet above mean low water, embankments being placed where the natural bank is below the latter elevation. The exterior or river face of the grading to have a slope of 1 on 2½ and the interior face a slope of 1 on 1½. The exterior slope to be ballasted with two 6-inch layers of stone backing, part of which is to be derived from reducing the stone protection of 1895 and part furnished by the contractor. The lower layer of backing to be fine; the upper coarse. The backing to be covered with concrete blocks laid in regular courses and close order. The blocks to be about 4 feet to about 6½ feet long, 18 inches wide, and 8 inches thick. The toe of the river slope of the embankment, also the stone backing and the concrete blocks, to be held in place and protected against undermining wave action by a buttress extending to mean low water, consisting of a line of round oak piles spaced 10 feet from centers and driven to 15 feet below mean low water, having a continuous oak wale bolted along their shore faces. Three-inch sheet piling, driven 12 feet below mean low water, to be spiked to the shore face of the wale. A continuous oak string piece, against which the lower course of concrete blocks is to abut, to be bolted to the inshore face of the sheeting through it and the wale. The top and bottom courses of the concrete blocks to be of special shapes to meet slope requirements, and the former tied together by steel cramps. At the corner formed by the junction of the two sections of revet-

ment of the northern and western shores at the head of the island monolithic concrete to be used instead of concrete blocks. The composition of the concrete to be one, three, and five parts, respectively, of Portland cement, sand, and broken stone.

"If required, an apron of stone riprap 6 feet wide by 12 to 18 inches thick to be laid on the river side of parts or for the whole length of the pile buttress."

The details of the revetment are shown on Plate I,¹ accompanying.

The work is in an unfinished condition, and no part of it is entirely completed. There are, therefore, no beneficial results derived from it.

In accordance with your instructions, specifications for proceeding with the work under formal contract were prepared and submitted in August, 1900. Proposals for doing the work were invited in the public prints in October, 1900, and award made to Lane Bros. & Co., of Esmont, Va. This firm entered into a contract with the United States December 6, 1900, approved by the Chief of Engineers January 2, 1901.

On January 22, 1901, bench marks were established and the work staked out. During January the contractors constructed a pile driver and made other preparations for the work, which was begun February 1 following.

The progress made in constructing the pile buttress has been slow, but a small proportion being entirely completed. This is the result, to some extent, of high tides and unfavorable weather, but more on account of indifferent management by the contractors and their not fully anticipating the requirements of the work and providing suitable plant.

As the plane of the top of the buttress is to be at mean low water, the employment of a cofferdam for performing the different operations of attaching wales to piling and spiking and sawing off sheet piling is generally necessary. Instead of using this means, the contractors have resorted to the expedient of using light embankments, which are frequently broken by waves, causing temporary suspension of work.

The status of the work at the close of the fiscal year was approximately as follows:

3.7 per cent of the pile buttress completed.

50 per cent of the pile buttress partly constructed.

54 per cent of the concrete blocks made but not laid.

80 per cent of the stone protection of 1895 removed.

20 per cent of the embankment made.

About 240 cubic yards of the stone protection of 1895 has been reduced to backing and concrete stone and a part of the same materials which are to be furnished by the contractors delivered.

The brand of cement being used is Lehigh Portland. The results of tests of briquettes of neat cement made during the progress of the work are as follows:

Number of sample.	Tensile strength.				Per cent passing No. 50 sieve.	Began setting.
	1-day test.		7-day test.			
	Maxi- mum.	Mini- mum.	Maxi- mum.	Mini- mum.		
1.....	375	344	.....	.....	98	<i>Hrs. Min.</i> 3 0
2.....	378	268	898	636	99½	2 15
3.....	383	270	899	644	99	4 30
4.....	416	360	925	805	99	3 30

About three-fifths of the concrete blocks have been made. On account, however, of the contractors not being prepared for placing the blocks, that branch of the work has not been begun.

* * * * *

The time reported lost to June 30 on account of high tides and bad weather amounts to 46 days.

The inspection of the work to May 31 was in charge of Mr. John Tyler, jr.; since that date of Mr. L. A. Guy.

Very respectfully, your obedient servant,

SAML. H. YONGE,
Assis't Engineer.

Lieut. Col. CHAS. J. ALLEN,
Corps of Engineers, U. S. A.

¹ Omitted.

J 14.

PRELIMINARY EXAMINATION OF QUANTICO CREEK, VIRGINIA.

[Printed in House Doc. No. 101, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 20, 1900.

SIR: I have the honor to submit herewith for transmission to Congress copy of report, dated September 12, 1900, by Lieut. Col. Charles J. Allen, Corps of Engineers, upon preliminary examination of Quantico Creek, Virginia, authorized by the emergency river and harbor act approved June 6, 1900.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF LIEUT. COL. CHAS. J. ALLEN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., September 12, 1900.

GENERAL: I have the honor to submit the following report of a preliminary examination at Quantico Creek, Virginia, made in accordance with the requirements of section 2 of the act of Congress approved June 6, 1900, "making provision for emergencies in river and harbor work, for certain surveys," etc.

A preliminary examination of the creek was made in October, 1894, in compliance with provisions of the river and harbor act of Congress, August 18, of that year. The engineer officer in charge of the examination stated in his report of December 17, 1894, that in his judgment Quantico Creek was not worthy of improvement by the General Government, an opinion which was concurred in by the division engineer and the Chief of Engineers.

Quantico Creek received several surveys and examinations previous to the examination of 1894, viz, in 1871, 1882, 1883, and 1888. These surveys and examinations, 1871-1888, were made with views to two partially distinct projects for improvement, viz, the improvement of navigation from the mouth of the creek to Dumfries and the improvement of Quantico Bay so as to form a safe winter or ice harbor. None of the surveys or examinations made have been followed by any appropriation by Congress for improvement at Quantico Creek.

The preliminary examination of the creek required by the act of June 6, 1900, was made August 22, under my direction, by Mr. F. C. Warman, assistant engineer. A copy of the report of his examination is herewith.

Quantico Creek enters the Potomac River at a point $32\frac{1}{2}$ miles below the city of Washington, D. C. It is about 4 miles in length. For a distance of about $2\frac{1}{2}$ miles above its mouth the width is from 2,200 to

3,000 feet. This part of the creek is sometimes called Quantico Bay, over the greater part of which the depth varies from 1 to 2 feet at mean low tide. The channel through this bay is narrow and tortuous, generally following the left shore of the bay. The depth of water at the mouth of the creek is 10 feet. A division of the Philadelphia, Wilmington and Baltimore Railroad crosses the creek on a pile trestle bridge at a point 1,500 feet above the creek's mouth. This trestle bridge has a draw 25 feet wide. The least depth between the mouth and the bridge draw is 8 feet. About 3 miles above the mouth there is an old canal, which formerly extended to Dumfries, 4 miles above the mouth of the creek. This canal was about 60 feet wide, and it is said that its original depth was 4 to 5 feet.

Along the left bank of the creek is a narrow-gauge railroad, passing through Dumfries and having a terminus at a wharf on Potomac River with about 25 feet depth of water in front of it. There is deep water in Potomac River at Quantico. There are the remains of two wharves at this town from which shipments were formerly made.

As to the present and prospective commerce of the locality, complete commercial statistics could not be obtained.

Mr. J. F. Wheat, in a communication for the people of Dumfries and vicinity, estimates that at least 600,000 "tons of iron ore and sulphur," 1,000,000 feet B. M. of lumber, and 100,000 cords of wood reached deep water from Quantico during the past year "with back freights of tons of fertilizer and lime for the farmers," and advances the opinion that with a 40-foot width and 6-foot depth at low water of channel through Quantico Creek the output would double or treble the foregoing estimate, and that all ores mined would seek outlet to deep water by way of Quantico Creek.

Mr. Warman, however, is of opinion, from information furnished him, that probably about 20,000 tons of iron ore and 8,000 tons of railroad ties, lumber, cord wood, etc., were shipped from this region last year, and that only about one-half of the ore and of the other articles was shipped by water (the ore, however, being carried directly to the Potomac River on the narrow-gauge railroad and not finding an outlet through the creek), the remainder going by rail.

The population of Dumfries is given as about 150; that of Potomac City, at the mouth of the creek, generally known as Quantico, as about 120. In fact, the entire population of the locality is given as about 400 to 500.

The cost of dredging a channel to the town of Dumfries (that section being the only one asking for such channel) is estimated at \$35,000, an expense evidently not warranted by the present or immediately prospective business of the locality.

I am therefore of the opinion that the locality is not worthy of improvement by the General Government.

With this report is a copy of the letter of Mr. Wheat, above referred to, and a map¹ of the locality.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

¹Not printed.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 25, 1900.

Respectfully submitted to the Secretary of War, concurring in the opinion of the local officer that improvement of the locality by the General Government in the manner indicated by the act authorizing the examination is not advisable.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,
October 27, 1900.

The views of the local officer, as concurred in by the Chief of Engineers, are approved.

ELIHU ROOT,
Secretary of War.

REPORT OF MR. F. C. WARMAN, ASSISTANT ENGINEER.

WASHINGTON, D. C., *August 27, 1900.*

COLONEL: I have the honor to submit the following report of a preliminary examination of Quantico Creek, Virginia, made August 21, 1900, in compliance with your verbal instructions and with the provisions of the emergency river and harbor act of June 6, 1900.

Quantico Creek is a tributary of the Potomac River, which it enters on the right about $34\frac{1}{2}$ miles below the Aqueduct Bridge at Washington, D. C., at Shipping Point, which is the southern point of confluence of the two streams. The creek is situated entirely in Prince William County, Va. It is about 4 miles in length from its mouth to the town of Dumfries. For a distance of about $2\frac{1}{2}$ miles above the mouth the width ranges from 2,200 to 3,000 feet, and the creek is a wide shallow tidal estuary, sometimes known as Quantico Bay, over the greater part of which the depth ranges from 1 to 2 feet at low tide. Through these flats a narrow, tortuous channel makes its way, following generally the left bank of the stream. At the mouth a depth of 10 feet is found. The old Alexandria and Fredericksburg Railroad, now known as the Maryland Division of the Philadelphia, Wilmington and Baltimore Railroad, crosses the creek on a pile trestle bridge 1,500 feet above the mouth. The bridge has a draw 25 feet wide. The depth at the draw is 11 feet, and the least depth between the draw and the mouth of the creek is 8 feet, while the width of the channel between these points ranges from 150 to 220 feet.

Passing above the railroad bridge the channel, after widening to about 350 feet, narrows rapidly to 150 feet and then more gradually to 50 feet. The depths above the bridge range from about 8 to 13 feet up as far as Point of Rocks, three-fourths of a mile by way of the channel, from the mouth of the creek. Above Point of Rocks the channel rapidly shoals to 6 and then to about 3 feet, until about $1\frac{1}{2}$ miles above the mouth it is practically lost in the wide flats. At the head of the bay, $2\frac{1}{2}$ miles above the mouth, the width suddenly decreases to about 800 feet, the depth being $2\frac{1}{2}$ to 3 feet. About 3 miles from the mouth and one-fourth of a mile above Dodges Landing an old canal cut through the marshes above enters the creek. This canal formerly extended up to Dumfries, was about 60 feet wide and is said to have been from 4 to 5 feet deep. The old bed of the creek there becomes a small and crooked stream from 30 to 50 feet wide, which a small rowboat can not navigate at low water.

The old town of Dumfries, at one time a port of entry and possessed of considerable shipping, some of it even being engaged in the foreign trade, has gradually fallen into decay until it now presents the appearance of a dilapidated village and has a population of about 150 persons. Potomac City, at the mouth of the creek, generally known as Quantico, has a population of about 120. Between these two towns there

are but two or three houses scattered along the shores of the creek, and the entire population tributary to the creek will probably not exceed 400 or 500.

There are a few wood landings on the creek and considerable quantities of cord wood, lumber, and railroad ties were noticed piled up ready for shipment. Practically no business is now done on the creek above Dodges Landing.

Commercial statistics were difficult to obtain, and when procured the quantities stated by different parties varied greatly. Probably about 20,000 tons of iron ore and 8,000 tons of railroad ties, lumber, cord wood, etc., were shipped from this region last year. Only about half of the ore and of the other articles is shipped by water, the remainder being shipped by rail.

Practically all the iron ore is at present obtained and shipped from the Cabin Branch mines, operated by Louis F. Detrick, of Baltimore. These mines are situated about $1\frac{1}{2}$ miles above the town of Dumfries, and from them a very good quality of iron pyrites is obtained. The shipments of iron ore are well provided for by a narrow-gauge railroad, about 7 miles long, which runs from the mines through Dumfries and along the left shore of Quantico Creek to a wharf on the main channel of the Potomac River. This railroad at first terminated at one of the upper landings, but in order that lightering might be avoided and deeper draft vessels be employed it was first extended to Point of Rocks, or Bullets Landing, and subsequently to its present terminus on the Potomac proper. It also connects with the Philadelphia, Wilmington and Baltimore Railroad just above Quantico Creek. There is 27 feet of water off of the present wharf, and the ore which is shipped by water is now loaded almost exclusively upon deep draft vessels and barges, this being more economical than the use of small vessels. The business of this company has so much increased that they are considering the advisability of changing to a standard-gauge line, which would probably increase the proportion of their shipments by rail. No request for further channel facilities is made by this interest. Mr. H. R. Haines, the manager of the Cabin Creek mines, stated that unless the creek should be improved to a width and depth considerably beyond what might reasonably be expected, his company would derive no benefit from it whatever, except possibly a little saving in the hauling of coal out to the mines, which would be inconsiderable.

It is stated that other mines are in course of development, but from what I was able to learn they have not as yet met with ore in paying quantities. If they are successful in this respect, they will probably find it of advantage to construct similar lines of railroad from their mines to the railroads and deep water near the mouth of the creek, as even if the creek were improved as far up as Dumfries there would be a considerable length of haul to the mines and the incident expenses for loading and unloading.

The banks of the stream were formerly heavily wooded, but I was informed that the greater portion of the timber for miles around has already been cut off and shipped. Mr. Haines states that in the 25,000 acres owned by his company it would be difficult to find 25,000 railroad ties (or 1 tie per acre).

Quarries were at one time opened in the sandstone, which is found in considerable quantities in the bluffs, but all work of this character has been practically abandoned.

It is claimed that a light-colored clay, valuable in the manufacture of buff bricks, exists in large quantities near Dumfries. From what I was able to learn, however, the same formation exists also in large quantities near the mouth of the creek, and although it has been examined several times it has never been used to any considerable extent.

A survey of Quantico Creek was made in 1871 (see Annual Report of the Chief of Engineers for 1872, p. 713); a preliminary examination in 1882 and a survey in 1883 (see Annual Report of the Chief of Engineers for 1884, Part II, p. 1010); another preliminary examination in 1888 (see Annual Report of the Chief of Engineers for 1889, Part II, p. 1030); and still another preliminary examination in 1894 (see Annual Report of the Chief of Engineers for 1895, Part II, p. 1254).

The above examinations and surveys were made with reference to two partially distinct projects, viz: (1) The improvement of the navigation of the creek up to Dumfries, and (2) the improvement of Quantico Bay to afford a safe and commodious winter or ice harbor.

The survey of 1872, which was made by Capt. C. B. Phillips, Corps of Engineers, had reference to both of these projects, and both were unfavorably reported upon.

The examination of 1882 and survey of 1883 likewise had reference to both projects. At this time there was considerable trade from the wharves near the mouth of the creek, and Mr. S. T. Abert, United States agent, then in charge of the office, while submitting an unfavorable report upon the first project, recommended the adoption of the latter. No appropriation was made, however.

The examination of 1888, also made by Mr. Abert, had especial reference to the

second project, and was favorably reported upon by him. Mr. Abert's recommendation was, however, disapproved by the division engineer and the Chief of Engineers.

The examination of 1894 had reference to the first of the above projects only, shipping from the wharves at the mouth of the creek having been largely discontinued and no request being made for the second projected improvement. The creek was reported as unworthy of improvement by Maj. Charles E. L. B. Davis, the officer in charge, and his view was concurred in by the division engineer and Chief of Engineers.

At the time of the present examination I found that no request is made for or interest taken in the improvement of the bay or lower creek. In fact the old wharves just above Shipping Point have been allowed to rot until little remains but the piles, and the same may be said of the Quantico wharf, which was well located and reached deep water in the Potomac River. The people of Quantico and immediate vicinity evidently prefer to ship their produce and supplies over the railroads.

The improvement desired is the first project mentioned above, viz, the opening of a channel to the town of Dumfries, and is requested by the people of that section only. They state that a channel 40 feet wide and 6 feet deep at low tide, with a turning basin at the head of the old canal, would afford all the facilities they desire. From maps of former surveys I estimate that this would require the removal of about 175,000 cubic yards of material, which, at 20 cents per yard for dredging and contingencies, would cost \$35,000.

While the improvement of this stream would undoubtedly be of benefit to the people of Dumfries and vicinity, the interests of trade and commerce are so small and the benefits derived would be so local in character that I would respectfully report that, in my judgment, Quantico Creek is not worthy of improvement by the General Government.

Very respectfully,

F. C. WARMAN,
Assistant Engineer.

Lieut. Col. CHARLES J. ALLEN,
Corps of Engineers, U. S. A.

LETTER OF MR. J. F. WHEAT.

DUMFRIES, VA., *August 24, 1900.*

DEAR SIR: In behalf of the inhabitants of the town of Dumfries and also those of a large section adjacent thereto, would respectfully report that it would be very desirable and advantageous to a large scope of country of Prince William and Stafford counties to have the Government appropriate a sufficient sum of money to open a channel, 40 feet wide and not less than 6 feet deep, from the mouth of Quantico Creek to the head of the old canal, with a basin at its head sufficient to allow boats to turn around.

If we take the output of lumber, cord wood, and railroad ties, and iron pyrites and sulphur that find an outlet to deep water from Quantico for the past year, which will run up to at least 600,000 tons of iron ore and sulphur, 1,000,000 feet of lumber, 100,000 cords of wood, with back freights of tons of fertilizer and lime for the farmers, with a 40-foot channel not less than 6 feet depth at low water, the output of the foregoing would double, yes, treble the above estimate. Several other mines are in course of development. Pittsburg capitalists are now operating southwest of the Boston Bradley Fertilizer mines and S. D. Crenshaw, of Richmond, northeast. All ores mined would seek outlet to deep water by way of Quantico Creek.

Then with navigable water up to the town for boats drawing 4 to 5 feet of water, say 6 feet loaded, the rich valley lands of Quantico would be turned into trucking farms and fruit. With numbers who would engage in the dairy business, with a steamer running daily to Washington, an immense trade would be opened up that would benefit this section of Virginia millions of dollars.

It is true a narrow-gauge road runs from the Detrick mines to the river, passing through the town, but this is a private road, and neither the merchants of the town nor the farmers are permitted to transport anything over it.

The expenditures necessary to cut a channel 40 feet wide, not less than 6 feet at low water, should not exceed \$40,000. Surely the Government, then, will help us in so small a matter as the expenditure of that little sum. It seems to us that the cost would not exceed \$10,000 per mile, and we estimate the distance from the mouth of Quantico to the head of the canal, with basin, at not quite 4 miles, air line.

We have begged and pleaded for this improvement ever since 1865, the close of the

war between the States, and our appeal seems to have been in vain. Whereas other creeks of very much less importance have secured appropriations from time to time, and as yet not one dollar for Quantico, a creek of as much importance as Ocoquan, Aquia, Chappawannie, Powells, and Neabsco, all combined. No mistake about it. You have only to send a man to see for himself the quantity of wood and lumber piled along its banks awaiting shipment and impossible to ship only at unusual high tides, and that occurs but once or twice a year. For instance, if a man cuts 1,000 cords of wood this winter it requires about three years to get it into market, and by that time the wood is so damaged it will scarcely bring the cost of manufacture and transportation.

Hoping we may receive favorable consideration at the hands of the Government in a matter of so great importance to a large class and section of country,

We are, very respectfully, yours,

J. F. WHEAT,

For the People of Dumfries and Vicinity.

Lieut. Col. CHAS. J. ALLEN,
Corps of Engineers, U. S. A.

APPENDIX K.

IMPROVEMENT OF NORFOLK HARBOR, VIRGINIA, AND ITS APPROACHES, AND OF RIVERS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|--|---|
| 1. Harbor at Norfolk and its approaches, Virginia. | 8. Inland water route from Norfolk, Virginia, to Albemarle Sound, North Carolina. |
| 2. Western branch of Elizabeth River, Virginia. | 9. Edenton Bay, North Carolina. |
| 3. Nansemond River, Virginia. | 10. Roanoke River, North Carolina. |
| 4. Appomattox River, Virginia. | 11. Removing sunken vessels or craft obstructing or endangering navigation. |
| 5. Harbor at Cape Charles City, Virginia. | |
| 6. Nandua Creek, Virginia. | |
| 7. Waterway from Norfolk, Virginia, to the sounds of North Carolina. | |

EXAMINATIONS AND SURVEYS.

- | | |
|---------------------------------|------------------------------------|
| 12. Norfolk Harbor, Virginia. | 14. Pagan River, Virginia. |
| 13. Appomattox River, Virginia. | 15. Chesconnessex Creek, Virginia. |

ENGINEER OFFICE, UNITED STATES ARMY,
Norfolk, Va., July 19, 1901.

GENERAL: I have the honor to transmit herewith my annual report upon the works of river and harbor improvement in my charge during the fiscal year ended June 30, 1901.

Very respectfully, your obedient servant,

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

K 1.

IMPROVEMENT OF HARBOR AT NORFOLK AND ITS APPROACHES, VIRGINIA.

Nothing was done in the way of improvement during the fiscal year 1901. The expenditures noted were made in connection with locating new wharves and plotting their position on office maps. Of the amount expended, \$50 represents the cost of preparing an estimate of

the cost of dredging in front of the railroad wharves at Pinner Point, submitted under an item in the emergency river and harbor act of June 6, 1900, covering a preliminary examination of the locality and a survey, if deemed worthy.

The tabular statement appended will indicate the traffic of the harbor during the calendar year 1900.

The available balance and the amount estimated to complete the project could be expended to advantage for dredging the flats at the mouth of the Southern Branch of the Elizabeth River, on the Berkley side, to within 75 feet of the pier-head lines. This will complete the project of 1885, except the dredging proposed between the Norfolk and Western Railway and the Campostella bridges, on which section improvement is not now needed.

Norfolk Harbor is in the collection district of Norfolk and Portsmouth, and Norfolk, Va., is the nearest port of entry. Nearest light-house is Craney Island light, at mouth of Elizabeth River, Virginia. Nearest fort, Fort Monroe, Va.

Amount of revenue collected at port of Norfolk, Va., during the fiscal year ended June 30, 1901, \$71,023.82.

Money statement.

July 1, 1900, balance unexpended	\$3,601.02
June 30, 1901, amount expended during fiscal year	133.79
July 1, 1901, balance unexpended	3,467.23
{ Amount (estimated) required for completion of existing project	56,774.56
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	56,774.56
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Improving harbor at Norfolk, Va.:	
August 14, 1876.....	\$35,000.00
June 18, 1878	50,000.00
March 3, 1879	75,000.00
June 14, 1880.....	50,000.00
March 3, 1881	75,000.00
August 2, 1882	75,000.00
July 5, 1884.....	25,000.00
August 5, 1886	50,000.00
August 11, 1888	50,000.00
September 19, 1890	150,000.00
July 13, 1892	150,000.00
August 18, 1894	100,000.00
June 3, 1896.....	100,000.00
Improving Elizabeth River, Virginia:	
July 7, 1898.....	360,000.00
Total.....	1,345,000.00
Amount turned into surplus fund of the Treasury from appropriation of July 7, 1898	483.58
Aggregate	1,344,516.42

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the harbor at Norfolk, Va., during the calendar year 1900, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.
	<i>Tons.</i>	
Coal.....	2, 138, 400	\$5, 364, 549
Lumber.....	149, 668	1, 643, 178
Logs.....	363, 227	1, 760, 190
Ice.....	2, 000	1, 000
Grain.....	101, 899	1, 834, 194
Bricks.....	16, 000	40, 000
Fertilizers.....	28, 000	247, 760
Miscellaneous.....	2, 738, 857	208, 771, 375
Total.....	5, 538, 051	219, 662, 236

From the data supplied by shippers it is impossible to show the required information respecting vessels using the harbor.

Approximate amount of freight of all kinds received and shipped by water.

	<i>Tons.</i>		<i>Tons.</i>
1888.....	1, 914, 506	1895.....	5, 013, 185
1889.....	2, 243, 087	1896.....	5, 986, 636
1890.....	2, 384, 841	1897.....	9, 430, 526
1891.....	2, 931, 751	1898.....	6, 510, 201
1892.....	3, 427, 189	1899.....	6, 260, 284
1893.....	3, 584, 727	1900.....	5, 538, 051
1894.....	4, 545, 049		

K 2.

IMPROVEMENT OF WESTERN BRANCH OF ELIZABETH RIVER,
VIRGINIA.

No work was done on the stream during the fiscal year and no expenditures were made.

The balance available is being held to defray the cost of a survey, which is necessary to determine whether the channel depths are likely to be permanent or not.

This river is in the collection district of Norfolk and Portsmouth, Va., and Norfolk, Va., is the nearest port of entry. Nearest light-house, Craney Island light, at the mouth of Elizabeth River, Virginia. Nearest fort, Fort Monroe, Va.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ending June 30, 1901, is \$71,023.82.

Money statement.

July 1, 1900, balance unexpended	\$373. 77
July 1, 1901, balance unexpended	373. 77

APPROPRIATION.

June 3, 1896	\$45, 000
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COMMERCIAL STATISTICS.

No replies were received to inquiries as to the commerce of this stream during the calendar year 1900.

Approximate amount of freight of all kinds shipped and received by water.

	Tons.
1896	211,653
1897	244,803
1898	346,835
1899	576,898

K 3.

IMPROVEMENT OF NANSEMOND RIVER, VIRGINIA.

No work was done during the fiscal year.

The subject of revising the project for improvement, so as to provide for the attainment of a channel 80 feet wide in lieu of the one varying from 400 to 200 feet in width contemplated under the project of 1888, was taken up in a report submitted to the Chief of Engineers April 3, 1901, after a personal inspection of the stream by the district officer.

It will be observed, from the statement of the annual shipments on this river, that the commerce has been decreasing since 1893, and while it is probable that for the last calendar year the commerce was somewhat greater than is indicated, owing to the failure of shippers to reply to inquiries, it is not sufficient to warrant the expenditure of over \$100,000, when the prospect is that the channel which would be made available by the expenditure of that amount would be vastly greater than the necessities require.

By slight dredging and easing of abrupt bends between the Western Branch and Suffolk, Va., a channel ample for the present requirements of commerce could be made available. Below the Western Branch two troublesome shoals exist. A channel 80 feet wide, and 12½ feet deep at mean low water through these shoals would answer the needs of commerce, and would not cost over \$1,000, providing this work was combined with the contract for the other desirable work mentioned above.

The balance in hand, with the addition of \$1,000, will be ample to do the dredging in the river below Suffolk and the shoals below the Western Branch, providing the work is combined in the same contract. This arrangement will result in a saving of \$101,500 on previous project.

The Chief of Engineers has directed that estimates for a channel in excess of 80 feet wide be omitted, and, unless otherwise directed by law, the improvement will be reported as completed when a channel over that extent has been provided, and no further estimates for a larger channel submitted, unless Congress so directs.

The funds available are to be applied to dredging the river below Suffolk, and the balance of the estimate, when appropriated, to dredging the two shoals below the Western Branch.

This river is in the collection district of Newport News, Va., and Newport News, Va., is the nearest port of entry; nearest light-house, Pig Point light, at mouth of river; nearest fort, Fort Monroe, Va.

The amount of revenue collected at the port of Newport News, Va., during the fiscal year ending June 30, 1901, is \$1,101,923.41.

Money statement.

July 1, 1900, balance unexpended	\$9, 872. 96
June 30, 1901, amount expended during fiscal year	3. 02
July 1, 1901, balance unexpended	9, 869. 94
{ Amount (estimated) required for completion of existing project	\$1, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	1, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1873	\$15, 000	July 13, 1892	\$10, 000
March 23, 1874	10, 000	August 18, 1894	10, 000
March 3, 1875	5, 000	June 3, 1896	5, 000
March 14, 1876	5, 000	March 3, 1899	5, 000
June 18, 1878	20, 00		
August 11, 1888	100, 00	Total	87, 000
September 19, 1890	10, 000		

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Nansemond River, Virginia, during the calendar year 1900, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.
	<i>Tons.</i>	
Lumber	560	\$11, 200
Coal	2, 500	12, 500
Ice	5, 000	10, 000
Lime	200	400
Oysters	1, 000	25, 000
Miscellaneous	7, 433	185, 825
Total	16, 693	244, 925

Movement of vessels.

Class.	Number.	Average draft.
		<i>Fect.</i>
Steam	1	7
Sail	8	12
Barges	4	12
Total	13	

Approximate amount of freight of all kinds shipped and received by water.

	<i>Tons.</i>		<i>Tons.</i>
1888	109, 900	1895	59, 701
1890	217, 738	1896	61, 405
1891	78, 572	1897	43, 500
1892	133, 723	1898	31, 796
1893	59, 473	1900	16, 693
1894	53, 762		

K 4.

IMPROVEMENT OF APPOMATTOX RIVER, VIRGINIA.

No operations were carried on during the fiscal year.

The amount estimated as required in the fiscal year 1903 will be applied to dredging out deposits of sand carried into the channel by freshets.

This river is in the collection district of Petersburg, Va., which is the nearest port of entry; nearest light-house, Jordan Point light, in the James River, Virginia; nearest fort, Fort Monroe, Va.

The amount of revenue collected at the port of Petersburg, Va., during the fiscal year ended June 30, 1901, is \$2,259.40.

Money statement.

July 1, 1900, balance unexpended	\$33. 31
June 30, 1901, amount expended during fiscal year	11. 34
July 1, 1901, balance unexpended	21. 97
{ Amount (estimated) required for completion of existing project	48,090. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	10,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1871	\$50,000	July 5, 1884	\$25,000
June 10, 1872	40,000	August 5, 1886	18,750
March 3, 1873	30,000	August 11, 1888	15,000
June 23, 1874	30,000	September 19, 1890	15,000
March 3, 1875	30,000	July 13, 1892	15,080
August 14, 1876	30,000	August 18, 1894	5,000
June 18, 1878	30,000	June 3, 1896	5,000
March 3, 1879	20,000	March 3, 1899	5,000
June 14, 1880	20,000		
March 3, 1881	20,000	Total	438,830
August 2, 1882	35,000		

COMMERCIAL STATISTICS.

The following statistics, relative to the commerce of the Appomattox River, Virginia, during the calendar year 1900, were furnished by Mr. W. N. Mays, harbor master, Petersburg, Va.:

Articles.	Amount.	Value.
	<i>Tons.</i>	
Fertilizer	5,727	\$70,000
Grain	6,999	5,000
Coal	4,284	25,000
Lumber	68,735	330,719
Railroad ties	10,000	7,203
Merchandise	60,000	314,608
Total	155,745	752,530

Movement of vessels.

Class.	Number.	Average draft.
		<i>Feet.</i>
Steam.....	1,040	8
Sail.....	352	8
Barges.....	161	9
Total.....	1,553	.....

Approximate amount of freight of all kinds received and shipped by water.

	Tons.		Tons.
1888.....	30,626	1896.....	81,318
1889.....	26,121	1897.....	84,031
1890.....	21,693	1898.....	95,941
1891.....	26,275	1899.....	Not obtained.
1892.....	25,218	1900.....	155,745

K 5.

IMPROVEMENT OF HARBOR AT CAPE CHARLES CITY, VIRGINIA.

Under the contract with Charles W. Johnston, for jetty construction, in force at the close of the previous fiscal year, 170 cubic yards of brush were placed for foundation of the south jetty and 699 tons of large stone deposited thereon. In completing the extension to the north jetty 209 tons of large stone were used in building it up to the adopted cross section from the unfinished condition in which this jetty was reported last year.

The contract was closed August 15, 1900, the resultant extension to the north jetty being 425 feet, completing it to the length projected. The south jetty was also started and built out from the shore line a distance of 244 feet. The outer 12 feet, however, is only about two-thirds completed.

The bay channel of this work has shoaled up considerably, and a portion of the amount of the estimate for the fiscal year 1903 is required to do necessary dredging. The south jetty should be built out as projected as early as possible, to give the much-needed protection to the entrance channel, and part of the amount asked for the improvement is to be applied to that purpose.

Cape Charles City Harbor is in the collection district of Cherrystone, Va., and Cape Charles City, Va., is the nearest port of entry. Fort Monroe, Va., is the nearest fort, and the nearest light-house is Cherrystone light.

No revenue was collected at the port of Cape Charles City, Va., during the fiscal year ended June 30, 1901.

Money statement.

July 1, 1900, balance unexpended	\$9,597.19
June 30, 1901; amount expended during fiscal year	9,304.45
July 1, 1901, balance unexpended	292.74
{ Amount (estimated) required for completion of existing project	87,340.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	40,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

September 19, 1890	\$25,000
July 13, 1892	10,000
March 3, 1899	20,000
Total	55,000

CONTRACT IN FORCE.

Name and address of contractor, Charles W. Johnston, Lewes, Del.

Date of approval, October 25, 1899.

Date of beginning work, December 1, 1899.

Date of expiration, August 15, 1900.

Prices: Large and small stone, \$2.50 per short ton; brush mattress, \$1.49 per cubic yard; brush, \$1.25 per cubic yard.

COMMERCIAL STATISTICS.

Inquiries were made as to the commerce of the harbor at Cape Charles City, Va., during the calendar year 1900, but no replies have been received.

Approximate amount of freight of all kinds shipped and received by water.

	Tons.		Tons.
1890	390,207	1895	455,269
1891	319,164	1896	487,004
1892	341,269	1898	569,894
1893	393,352	1899	591,298
1894	427,723	1900	No statement given.

K 6.

IMPROVEMENT OF NANDUA CREEK, VIRGINIA.

The contractor for the dredging which was being carried on at the close of the preceding fiscal year completed a channel 75 feet wide on the bottom and 90 feet wide at the top, 8 feet deep at mean low water, on July 31, 1900. In attaining this channel through the bar at the mouth, 19,133 cubic yards, scow measurement, of sand were removed, of which quantity 8,185 cubic yards were dredged in the present fiscal year.

The adopted project calls for a channel 100 feet wide and 8 feet deep at mean low water. The limited commerce of the creek can, however, be accommodated without inconveniencing navigation to any extent, by the channel provided, as long as it remains open; so there is no necessity at present for increasing its dimensions.

An examination will be made of the dredged channel in the early fall, to determine its condition, and for this purpose the small amount of funds available for the improvement will be expended.

Nandua Creek is in the collection district of Cherrystone, Va., and Cape Charles City, Va., is the nearest port of entry. Fort Monroe, Va., is the nearest fort, and nearest light-house is Cherrystone light.

No revenue was collected at the port of Cape Charles City, Va., during the fiscal year ended June 30, 1901.

Money statement.

July 1, 1900, balance unexpended	\$3, 663. 48
June 30, 1901, amount expended during fiscal year	3, 634. 80
July 1, 1901, balance unexpended	28. 68

APPROPRIATIONS.

June 3, 1896	\$3, 000
March 3, 1899	3, 000
Total	6, 000

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Nandua Creek, Virginia, during the calendar year 1900 were furnished by Mr. J. C. Boggs, of Nandua, Va.:

Articles.	Amount.	Value.
	<i>Tons.</i>	
Potatoes	97	\$40, 740
Fish	20	4, 000
Oysters and clams	50	2, 000
Miscellaneous	1, 000	25, 000
Total	1, 167	71, 740

Movement of vessels.

Steam	2
Sail	3
Total	5

K 7.

IMPROVEMENT OF WATERWAY FROM NORFOLK, VIRGINIA, TO THE SOUNDS OF NORTH CAROLINA.

Under the continuing contract of August 1, 1899, with the Virginia Dredging Company for executing all work in attaining the improvement as projected, operations were carried on during the fiscal year 1901 on each of the different sections of the route.

At Deep Creek 80,292 cubic yards of material were dredged and deposited between April 26 and June 30, 1901. This removal was made in excavating a 10-foot mean low-water channel from the site of the old dam downstream a distance of 3,100 feet from 75 to 100 feet wide.

Work on Turners Cut was continued throughout the fiscal year, from one to three dredges being operated. The yardage removed in widening the cut to a top width of 100 feet, over a distance of 7,500 feet to a depth of 10 feet at mean low water, and over 4,950 feet to a depth of 8 feet at mean low water, amounted to 205,671 cubic yards. The average width of cutting was 45 feet.

In the Pasquotank River, North Carolina, work was confined to cutting a channel 3,300 feet long, 100 feet wide, and 10 feet deep at mean low water through the bar at Shipyard Landing. This was accomplished by the removal of 43,607 cubic yards of material, scow measurement.

A channel across the bar off Croatan light, in Croatan Sound, North Carolina, 200 feet wide and 12 feet deep at mean low water was dredged, 12,872 cubic yards of material being removed and deposited. The distance over which the dredge moved in order to secure a continuous depth of 12 feet at mean low water throughout the sound was 1,050 feet.

At the close of the fiscal year arrangements had been completed by the contractor for starting the driving of sheet piling required on Turners Cut. About 15,000 linear feet of sheet piling will be necessary, of which 6,400 linear feet is to be put down on the east side of the cut and 8,600 linear feet on the west side.

This work is in the collection district of Norfolk and Portsmouth, Va., and Albemarle, N. C.; and Norfolk, Va., and Edenton, N. C., are the nearest ports of entry. The nearest light-houses are Wade Point light, in Albemarle Sound; Croatan light, in Croatan Sound, North Carolina, and Craney Island light, in Elizabeth River, Virginia. Fort Monroe, Va., is the nearest fort.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1901, is \$71,023.82.

Money statement.

July 1, 1900, balance unexpended	\$202, 718. 93
Amount appropriated by sundry civil act approved March 3, 1901	29, 870. 00
	232, 588. 93
June 30, 1901, amount expended during fiscal year	93, 243. 52
July 1, 1901, balance unexpended	139, 345. 41
July 1, 1901, outstanding liabilities	275. 00
July 1, 1901, balance available	139, 070. 41
July 1, 1901, amount covered by uncompleted contracts.....	124, 985. 60

APPROPRIATIONS.

March 3, 1899	\$25, 000
Act June 6, 1900	200, 000
Act March 3, 1901	29, 870
Total	254, 870

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: Virginia Dredging Company.

Date of approval: September 6, 1899.

Date of beginning work: September 11, 1899.

Date of expiration: January 1, 1902.

Rates: Dredging Deep Creek section, 15 cents per cubic yard, scow measurement. Turners Cut section: Dredging, 25 cents per cubic yard, measured on the bank; sheet piling, \$2 per linear foot; brush protection, \$1.50 per linear foot. Pasquotank River, North Carolina: Dredging Ship-yard Bar, 15 cents per cubic yard, scow measurement; projecting points, 27 cents per cubic yard, measured on the bank. Croatan Sound, North Carolina: Dredging, 30 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

The following statistics were furnished by Mr. S. W. Gary, superintendent of the Lake Drummond Canal and Water Company, and indicate the traffic through the Dismal Swamp Canal, Virginia and North Carolina, for eight months of the calendar year 1900, the canal having been closed the remaining four months of that year:

Articles.	Quantity.	Value.
Lumber.....feet B. M.	46, 226, 512	\$554, 718
Logs.....do.	1, 639, 014	16, 390
Logs.....cords.	774	1, 548
Piling.....linear feet	609, 478	36, 568
Shingles.....feet B. M.	125, 000	625
Railroad ties.....	2, 867	1, 434
Wood.....cords	526	1, 052
Machinery.....tons	13	2, 600
Corn.....bushels	44, 616	22, 308
Oysters.....do	675	505
Empty barrels.....	3, 725	373
Salt.....tons	167	501
Shells.....bushels	3, 800	152
Potatoes.....do	9, 412	5, 647
Sand.....tons	1, 762	440
Coal.....do	4, 573	13, 719
Phosphate.....do	3, 128	62, 560
Total value.....		721, 140
Miscellaneous.....tons	23, 114	Value not known.

Vessels.

Class.	Number.	Average draft.	Average tonnage.
Steamers.....	812	<i>Fect.</i> 8	31
Barges.....	533	9	175
Schooners.....	416	7	38
Lighters.....	20	6 in.	
Rafts.....	32		Average of 60,075 feet of lumber each.

K 8.

IMPROVEMENT OF INLAND WATER ROUTE FROM NORFOLK, VIRGINIA, TO ALBERMARLE SOUND, NORTH CAROLINA, THROUGH CURRITUCK SOUND.

After being equipped as a dredge, as noted in the report upon the improvement of the Roanoke River, North Carolina, for the present fiscal year, the United States snag boat *Roanoke* was placed at work to dredge a channel through the bar at the mouth of North River, North Carolina, one of the sections of this inland water route between Norfolk, Va., and Albermarle Sound, North Carolina.

The boat arrived at the bar April 30, 1901, and preparations were made on the following day for starting the dredging, but stormy weather prevented any work being done until the 10th of May, 1901. Unfavorable weather continued, and on the 25th of May the snag boat started for the Roanoke River, North Carolina, to clear the channel from a point about $1\frac{1}{2}$ miles below Weldon.

While at North River bar it was only possible, on account of weather conditions, for the snag boat to work on four days, and on these full time was not made.

The snag boat returned to the bar on the 22d of June to resume dredging, and from that date to the close of the fiscal year worked during a portion of three days. During the time employed in May and June, 1901, 170 and 142 cubic yards, respectively, of sand and clay were removed by the snag boat. Dredging was carried to a depth of 10 feet at mean low water, over a width of 30 feet, for a distance of 343 feet.

Of the expenditures reported for the fiscal year 1901, \$1,000 of the amount was charged to this work as its portion of the cost of lengthening the snag boat *Roanoke* and equipping it for service as a dredge.

The amount indicated below as required in the fiscal year 1903, together with the available balance June 30, 1901, is desired for application in dredging at North River bar, North Carolina, and possibly in redredging in the southern branch of the Elizabeth River, Virginia. The estimate for maintenance is to cover the cost of removing sunken logs, which may be detached from rafts passing through the route, and after becoming water-soaked, sink in the channel, thereby jeopardizing the propellers and hulls of vessels engaged in navigating the waters.

This work is in the collection districts of Norfolk and Portsmouth, Va., and Albemarle, N. C. Norfolk, Va., and Edenton, N. C., are the nearest ports of entry. Nearest light-house, Long Point light, in Coanjoek Bay, North Carolina. Fort Monroe, Va., is the nearest fort.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1900, is \$25,135.42.

Money statement.

July 1, 1900, balance unexpended.....	\$6,834.98
June 30, 1901, amount expended during fiscal year.....	1,778.52
July 1, 1901, balance unexpended.....	5,056.46
July 1, 1901, outstanding liabilities.....	130.67
July 1, 1901, balance available.....	4,925.79
{ Amount (estimated) required for completion of existing project.....	21,667.08
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$21,667.08
For maintenance of improvement.....	1,800.00
	23,467.08
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For southern branch Elizabeth River, Virginia:	
March 3, 1873.....	\$15,000.00
June 23, 1874.....	10,000.00
March 3, 1875.....	5,000.00
August 14, 1876.....	5,000.00
June 18, 1878.....	5,000.00
	\$40,000.00

For North Landing River, Virginia and North Carolina:

March 3, 1879	\$25,000.00	
June 14, 1880	15,000.00	
March 3, 1881	7,500.00	
August 2, 1882	8,000.00	
		\$55,500.00

For Currituck Sound, Coanjoek Bay, and North River Bar,
North Carolina:

June 18, 1878	20,000.00	
March 3, 1879	25,000.00	
June 14, 1880	25,000.00	
March 3, 1881	30,000.00	
August 2, 1882	20,000.00	
July 5, 1884	5,000.00	
August 5, 1886	10,000.00	
August 11, 1888	7,500.00	
		142,500.00

For inland water route, etc.:

September 19, 1890	10,000.00	
July 13, 1892	9,000.00	
August 18, 1894	10,000.00	
June 3, 1896	10,000.00	
March 3, 1899	8,000.00	
		47,000.00

Total	285,000.00
Amount received from sale of property to other works	2,169.69
Aggregate	287,169.69

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the inland water route from Norfolk Harbor, Virginia, to Albemarle Sound, North Carolina, during the calendar year 1900, were compiled from a statement furnished by the Albemarle and Chesapeake Canal Company:

Articles.	Amount.	Value.
	<i>Tons.</i>	<i>Dollars.</i>
Lumber	139,704	931,585
Shingles	13,615	108,924
Wood	1,215	6,075
Railroad ties	116	9,847
Miscellaneous	41,306	407,521
Total	195,958	1,463,952

Movement of vessels.

Class.	Number.	Average tonnage.
Steam	1,983	66
Sail	773	51
Barges	531	194
Lighters	79	35
Rafts	276	.....
Total	3,642	.....

K 9.

IMPROVEMENT OF EDENTON BAY, NORTH CAROLINA.

No actual operations were in progress during the fiscal year 1901. The expenditures reported were for a cursory examination of the improved channel.

The amount estimated as required for expenditure in the fiscal year 1903 can be applied with advantage to the commercial interests of the harbor in giving the channel the dimensions projected.

This improvement is in the collection district of Albemarle, N. C., and Edenton, N. C., is the nearest port of entry. Nearest light-house, Roanoke River light, North Carolina.

No revenue was collected at the port of Edenton, N. C., during the fiscal year ended June 30, 1901.

Money statement.

July 1, 1900, balance unexpended	\$186. 68
June 30, 1901, amount expended during fiscal year	8. 60
July 1, 1901, balance unexpended	178. 08
July 1, 1901, outstanding liabilities	4. 90
July 1, 1901, balance available	173. 18
{ Amount (estimated) required for completion of existing project	6,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	6,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act approved—	
June 18, 1878	\$4,000
March 3, 1879	1,000
July 5, 1884	10,000
August 5, 1886	2,000
Total	17,000

COMMERCIAL STATISTICS.

A full statement of the commerce of Edenton Bay, North Carolina, could not be obtained for the calendar year 1900. The freight handled by one line amounted to 36,000 tons.

Approximate amount of freight of all kinds shipped and received by water.

	Tons.
1898	160,109
1899	108,122
1900	(Full information could not be obtained.)

K 10.

IMPROVEMENT OF ROANOKE RIVER, NORTH CAROLINA.

The snag boat *Roanoke* was employed on the river from September 5 to November 15, 1900, in removing channel obstructions, and 13 trees, 2 snags, 1 log, and 1 stump were taken out and placed on the bank during that period. In addition, the banks at Shad Island Bend were trimmed. About 1 mile above the mouth of the stream an old wharf, which was found floating in the river, was broken up.

Under date of November 16, 1900, proposals for adding 20 feet to the hull of the snag boat, remodeling the stern so as to give the boat better backing qualities, and equipping the boom with a 1-yard dredge bucket were invited by an advertisement published in certain newspapers. The bids received in response were opened December 20, 1900. The bid of Charles J. Colonna, of Berkley, Va., for \$5,420, proved to be the lowest for the work. As no guaranty accompanied this proposal, the Chief of Engineers directed that all bids be rejected and an offer from Mr. Colonna to do the work for the consideration named in his bid be entertained and accepted, and contract, with bond, executed with him for the performance of the work.

The contract was duly executed December 31, 1900, and the boat was delivered over to the contractor January 10, 1901. The extension and alteration required were finished and the boat returned for service April 5, 1901.

After being rebuilt the snag boat was assigned to dredge the bar at North River, North Carolina, but as unfavorable weather prevented satisfactory progress, this work was stopped temporarily, and an examination of the Roanoke River improvement was made as far as the old steamboat landing near Weldon, N. C., primarily to ascertain work necessary to open up a navigable channel 4 feet deep at ordinary low water to a point a short distance above that place.

It is proposed to apply the available balance reported below to providing a channel from just below the site of the old railroad bridge to within a short distance of Weldon, N. C., and to the removal of channel obstructions in the lower river when required.

This river is in the collection district of Albemarle, N. C., and Edenton, N. C., is the nearest port of entry. Nearest light-house, Ronoake River light, North Carolina, at mouth of river; nearest fort, Fort Monroe, Va.

No revenue was collected at the port of Edenton, N. C., during the fiscal year ended June 30, 1901.

Money statement.

July 1, 1900, balance unexpended	\$25,377.96
June 30, 1901, amount expended during fiscal year	9,596.85
July 1, 1901, balance unexpended	15,781.11
July 1, 1901, outstanding liabilities	359.33
July 1, 1901, balance available	15,421.78
Amount (estimated) required for completion of existing project	41,000.00

APPROPRIATIONS.

March 3, 1871	\$20,000	July 13, 1892.....	\$50,000
June 10, 1872	10,000	August 18, 1894	30,000
March 3, 1873	10,000	June 3, 1896	10,000
June 23, 1874	5,000		
August 2, 1882	5,000	Total	228,000
July 5, 1884	3,000	Amount received from sale of	
August 5, 1886	20,000	property to other works	1,338
August 11, 1888	40,000		
September 19, 1890	25,000	Aggregate.....	229,338

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: Charles J. Colonna; consideration, \$5,420.

Date of approval: January 8, 1901.

Date of beginning work: January 10, 1901.

Date of expiration: April 5, 1901.

COMMERCIAL STATISTICS.

A full statement of the commerce could not be secured for the calendar year 1900. The replies received show an aggregate of 27,432 tons of freight carried on the river during that year.

Approximate amount of freight of all kinds received and shipped by water.

	Tons.		Tons.
1870	150,000	1892	42,039
1890	182,700	1893	121,024
1891	376,181		

K II.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of schooner Emblem.—This small vessel was sunk in 72 feet of water, at mean low tide, a short distance off from the engineer wharf at Fort Monroe, Va.

The removal of the wreck was authorized January 11, 1901, and the work was accomplished, at a cost of \$642.50, by means of explosives.

Bids for removing the wreck were solicited by public notice, and the award for the work was made to Charles W. Johnston, who commenced operations February 11, 1901, and had the wreck destroyed by the 15th of the same month. The contract price for the removal was \$550.

Wreck of dredge.—The wreck of this craft was in about 31 feet of water, at low tide, 6 miles southwest from Old Plantation light-house, Chesapeake Bay. Its removal was authorized February 27, 1901, and under date of March 19, 1901, proposals for the work were invited by advertisement inserted in certain newspapers, with the result that a contract was entered into with Charles T. Johnston, May 10, 1901, to execute the work for \$1,523.

The contractor began work June 11, and had destroyed the wreck as called for by the contract, on June 20, 1901. The total cost was \$1,871.75.

K 12.

EXAMINATION AND ESTIMATE OF COST OF IMPROVING NORFOLK HARBOR, VIRGINIA, IN VICINITY OF PIER OF SOUTHERN RAILWAY COMPANY.

[Printed in House Doc. No. 74, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 22, 1900.

SIR: I have the honor to submit herewith copies of letters, dated August 16 and November 9, 1900, from Maj. J. B. Quinn, Corps of Engineers, containing report upon preliminary examination and plan and estimate, respectively, with a view to remove bar and secure a depth of 28 feet at a point between the 28-foot channel and the pier of the Southern Railway Company near Norfolk, Va., required by the emergency river and harbor act of June 6, 1900.

The locality is considered by the local officer and the division engineer, Col. Peter C. Hains, Corps of Engineers, to be worthy of improvement by the United States to the extent of obtaining a depth of 28 feet at mean low water from the channel to within 75 feet of the established pierhead line. The estimated cost of the necessary dredging is \$20,000, which includes contingencies.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF NORFOLK HARBOR, VIRGINIA, WITH A
VIEW TO REMOVING BAR AND SECURING DEPTH OF 28 FEET AT
POINT BETWEEN THE 28-FOOT CHANNEL AND THE PIER OF THE
SOUTHERN RAILWAY COMPANY.UNITED STATES ENGINEER OFFICE,
Norfolk, Va., August 16, 1900.

GENERAL: In compliance with the instructions contained in the letter from your office, dated July 3, 1900, in connection with the preliminary examinations authorized to be made under the provisions of the emergency river and harbor act approved June 6, 1900, and assigned to me for investigation and report, I have the honor to submit the following as to the locality described in the item of the above-mentioned act quoted below:

Norfolk: To remove bar and secure depth of twenty-eight feet at point between the twenty-eight-foot channel and the pier of the Southern Railway Company near Norfolk, Virginia.

The Southern Railway owns three piers at Pinner Point, near Norfolk, and in front of each about the same condition as to depth of water

exists. The 28-foot channel is about 500 feet distant from the outer ends of the piers. The least depth between the piers and the channel is 25 feet at mean low water, although opposite the sides of the wharves, except on the upper side of pier No. 2, depths greater than 28 feet at mean low water exist out to the dredged channel. Between the lower side of the center pier and the upper side of the lower one, outside of the pier line and opposite the slip space between said piers, a lump covering an area of 375 by 350 feet, with depths of from 18 to 27 feet at mean low water, is located.

The object of the item authorizing the preliminary examination is evidently intended to cover the removal of the lump between the channel and one of the piers of the railway alluded to therein, and, since complaint has been made of a steamship grounding on leaving the upper side of the lower pier, it is presumed to refer to that one.

Off the end of this pier, about 140 feet from the lower corner and 240 feet from the upper corner, there is a lump over which there is from 25 to 27 feet of water at mean low tide. From the end of the pier to the 28-foot channel is about 500 feet. The cost of removal of this obstruction would not amount to much, but the work would seem to be of a private character. In a straight line from either side of the pier there is sufficient depth to the channel, but it is not always practicable for a ship to go from the wharf in a direct line, as the channel would be too narrow to turn either down or up stream without delay, and then with strong wind or tide it would be impossible to keep the ship on the course to the channel, especially as they most always back out from the pier.

Those interested are desirous of having the area in front of all the piers at Pinner Point dredged to 28 feet at mean low water, and I think it would be of advantage to the large commerce of the harbor of Norfolk to have this work done, as it would increase the facilities for docking ships at the piers and would permit of vessels anchoring off the docks without encroaching to such a great extent as they now do upon the navigable channel. This would not cost so very much, and the improvement would be of advantage to most all the commercial interests of the harbor.

Under the project for attaining 25 feet at mean low water in Norfolk Harbor, dredging to that depth above the car-barge slip at Pinner Point has been carried to within 75 feet of the established pierhead line, and I am of the opinion that the dredging to a depth of 28 feet at mean low water between that point to and opposite the breakwater below the Southern Railway pier No. 4, from the 28-foot channel to within 75 feet of the pier line, is justified by the commercial interests that would be benefited.

The freight handled from the wharves of the Southern Railway at Pinner Point amounted to about 445,000 tons during the calendar year 1899. The maximum draft of vessels sailing from the piers is 28 feet 7 inches.

The necessary data for the preparation of a project and plan of improvement, with estimated cost, can be compiled at an expense not exceeding \$100, which can be paid from the available balance for "improving harbor at Norfolk, Va."

The locality which I have described is worthy of improvement, but if it is considered that the item of the act only applies to the lower

pier of the Southern Railway I do not consider that the United States is warranted in undertaking the very small amount of work necessary, which would be of little practical service to the general commerce.

Respectfully submitted,

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

FORT BANKS, MASS., *August 20, 1900.*

Respectfully submitted to the Chief of Engineers, United States Army.

The main ship channel being the avenue provided by the United States for general commerce, it is expected that private owners will as a rule dredge at their own expense from the channel to the piers. In this case the harbor lines are located so far from the main channel that dredging between them, so as to afford shipping the means of reaching the docks, seems justified by the important interests involved.

In my opinion the work referred to is worthy of being done by the Government.

Very respectfully,

PETER C. HAINS,
Colonel, Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 24, 1900.

Respectfully submitted to the Secretary of War.

This report relates to a preliminary examination at Norfolk Harbor, Virginia (full text of item quoted within), required by the emergency river and harbor act of June 6, 1900.

Those interested in improvements at Pinner Point are desirous of having the area in front of all the piers there dredged to 28 feet at mean low water.

Under the project for obtaining 25 feet at mean low water in Norfolk Harbor, dredging to that depth above the car-barge slip at Pinner Point has been carried to within 75 feet of the established pierhead line, and Major Quinn is of opinion that the dredging to a depth of 28 feet at mean low water between that point to and opposite the break-water below the Southern Railway pier No. 4, from the 28-foot channel to within 75 feet of the pier line, is justified by the commercial interests that would be benefited.

Inviting attention to the views of the division engineer contained in preceding indorsement, I recommend that the local officer be directed to prepare a plan and estimate of cost of improvement in accordance with his views expressed within.

A. MACKENZIE,
Acting Chief of Engineers.

[Third indorsement.]

WAR DEPARTMENT,
August 25, 1900.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN C. SCOFIELD,
*Chief Clerk.*PLAN AND ESTIMATE OF COST FOR THE IMPROVEMENT OF THE PORTION
OF NORFOLK HARBOR, VIRGINIA, IN VICINITY OF PIERS AT PINNER
POINT.UNITED STATES ENGINEER OFFICE,
Norfolk, Va., November 9, 1900.

GENERAL: In compliance with the instructions contained in the letter from your office dated August 29, 1900, relative to the submission of a plan and estimate for the improvement of the portion of Norfolk Harbor, Virginia, in the vicinity of the piers at Pinner Point, I have the honor to make the following report:

In my preliminary report upon the subject of the improvement desired at the locality above mentioned, dated August 16, 1900, I stated that the area in front of the wharves at Pinner Point from opposite the breakwater on the north side of the pier, near the mouth of the Western Branch of the Elizabeth River, to opposite the car-barge slip on the south was worthy of improvement to the extent of attaining a depth of 28 feet at mean low water from the channel to within 75 feet of the established pierhead line, out to which line all wharves constructed at the point extend.

My estimate for dredging over the area described is as follows:

For removing and depositing 130,000 cubic yards, scow measurement, of mud mixed with sand, at 14 cents per cubic yard.....	\$18,200
Contingencies, inspection, etc	1,800
Total.....	20,000

If it should be advantageous to include the work under specifications for other dredging to be done in the harbor, it is quite probable that a saving in the estimated cost would result.

At present there are in existence and actual use five large warehouse wharves and a car-barge slip. Three of these wharves are owned by the Southern Railway, and, of the other two, one each by the Atlantic Coast Line and Norfolk and Carolina Railroad. The car-float slip is used by all three of the lines in barging inbound and outbound freight in cars to and from their wharves in Norfolk. The total shipments of freight from the piers at Pinner Point last year amounted to about 445,000 tons. Of this 106,972 tons was for export and was carried in 36 ships, drawing from 18 to 29 feet, which called at the wharves for cargo. Out of that number 16 were of too great a draft to either land or leave the piers during the low-water period without great danger of grounding on the shoal places directly in front of each pier. The average draft of the ships which called at the piers in 1899 was 24 feet 3 inches.

I feel satisfied that the improvement is warranted. The expenditure necessary to do the work is not large, and when the improvement has

been made these wharves will have no better facilities, considering their requirements, than those of the inner harbor, where dredging has been carried to within the same distance of the pierhead line as is proposed in the case of the locality mentioned.

The locality is worthy of improvement, in my opinion, to the extent set forth herein.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 13, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

To identify this report with the report on the preliminary examination, the item in the emergency river and harbor act approved June 6, 1900, authorizing the survey, is given, as follows:

Norfolk: To remove bar and secure depth of twenty-eight feet at point between the twenty-eight-foot channel and the pier of the Southern Railway Company near Norfolk, Virginia.

In my indorsement on the report of the preliminary examination I stated that "the main ship channel being the avenue provided by the United States for general commerce, it is expected that private owners will, as a rule, dredge at their own expense from the channel to the piers. In this case the harbor lines are located so far from the main channel that dredging between them so far as to afford shipping the means of reaching the docks seems justified by the important interests involved." That is still my judgment.

I concur in the opinion of the district engineer that the locality is worthy of improvement by the General Government to the extent indicated in this report.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

K 13.

EXAMINATION AND SURVEY OF APPOMATTOX RIVER, VIRGINIA.

[Printed in House Doc. No. 139, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 4, 1900.

SIR: I have the honor to submit herewith copies of reports, dated August 22, 1900, and November 23, 1900, by Maj. James B. Quinn, Corps of Engineers, upon examination and resurvey, respectively, of

Appomattox River, Virginia, authorized by the emergency river and harbor act approved June 6, 1900.

Appomattox River forms the harbor of Petersburg, Va., and the 11.5 miles of river between Petersburg and the mouth in James River has for many years been under improvement with a view of securing a depth of 12 feet at high water. The difficulties attending the maintenance of such a channel are due to the volumes of sand brought down by every freshet and deposited in the harbor and river below. The resurvey authorized by the act of June 6, 1900, has for its object the preparation of a plan and estimate of cost for the deflection of the river at Petersburg in order to prevent these obstructive deposits.

The project presented by Major Quinn provides for the construction of a dam, training dike, etc., at an estimate cost of \$266,915, and \$6,000 a year for maintenance for several years afterwards, and, in his opinion, the improvement is justified by the commercial interests involved.

In forwarding the survey report, the division engineer, Col. Peter C. Hains, Corps of Engineers, states that the plan proposed is feasible, but that in his opinion the estimate is too small, and the total cost of the work will be not less than \$400,000, and \$5,000 annually for maintenance. In conclusion he says:

In my opinion this work is worthy of being undertaken by the General Government, provided the full amount of \$400,000 is appropriated at one time, in order that the work may be carried out free from the dangers of interruption by large freshets.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF APPOMATTOX RIVER, VIRGINIA, WITH
A VIEW TO THE DEFLECTION OF THE RIVER AT PETERSBURG.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., August 22, 1900.

GENERAL: With reference to the item in the emergency river and harbor act of June 6, 1900, as to the—

Appomattox River: Resurvey and estimate for the deflection of the river at Petersburg—

I have the honor to report that in pursuance with the instructions contained in Department letter of July 3, 1900, respecting preliminary examinations authorized by the act above mentioned and assigned to me, I have made a preliminary examination of the Appomattox River and find the following conditions to prevail:

The river is about 100 miles long and drains a country that is coming under agricultural care more and more each year. In consequence the freshets are much more violent than in former years, when the drainage basin was not so thoroughly cultivated. The torrents produced carry large volumes of sand, and this sand is deposited in the bed at various places in the river's course, notoriously in the vicinity of Petersburg.

The river at this point forms the harbor of Petersburg and the commerce of the place is dependent upon maintaining a channel unobstructed by sand bars between the before-named place and the James River.

The improvement of the $11\frac{1}{2}$ miles of river, which courses between Petersburg and the James River, has been the subject of repeated examinations and reports, and it is not believed that a very elaborate examination will now be necessary to secure all the data which recent changes in the character of the improvements of this stream may have brought about.

To-day there is scarcely 6-foot navigation to Petersburg, and even this depth of water is unreliable, and the commerce is greatly damaged in consequence.

The city has kept a dredge at work removing the sand which forms bars after every rise in the stream and, as the volume of sand is steadily increasing, the effort to maintain a channel is well-nigh impossible. The uncertainties of a continuous channel are too great to warrant any enterprises which must possess evidences of permanency to insure confidence. To bring about some assurance that the stream will not be blockaded at unexpected intervals a project has been presented which seems to afford some promise of relief.

The river as far as Petersburg is a tidal stream under ordinary conditions, but the tidal currents are not sufficient to cause any satisfactory scouring out of the channel, and upon certain occasions act as counter currents to the descending flood water and arrest the sand-burdened currents, producing instantaneous shoaling, and is a source of almost impossible obstacle for successful prevention by human agencies so long as the migrating sand is allowed to flow into the harbor at Petersburg unobstructed and at will.

It is obvious that if this stream of sand could be diverted the shoaling of the harbor would be obviated, and it is entirely feasible to bring about this result with an expenditure which is entirely within the limits of due economy.

The scheme of diversion was reported upon by Captain Fiebeger, Corps of Engineers, in 1889 (see p. 955 et seq., Annual Report of the Chief of Engineers, United States Army, Part II, 1889), and it is believed that with some additional examinations, which would not cost much, the matter can be sufficiently elucidated.

The estimated cost of verifying some of the notes exhibited in Captain Fiebeger's report, and gaining such information relative to existing conditions of the channel and other matters pertinent to the subject, will not exceed \$400, which will have to be supplied from the appropriation for emergencies in rivers and harbors, act of June 6, 1900.

The city of Petersburg is improving rapidly and is more and more feeling the necessity of having water transportation for many articles which are produced in its vicinity. There is a large amount of lumber shipped under present adverse conditions, and this business would be greatly benefited by better facilities than those now offered. The granite quarries in the vicinity would be greatly benefited and the manufacturers would be also greatly favored. A shipyard is already under course of construction, and to such an institution navigable water is a self-evident necessity.

Beyond verbal representation which was made to me, I have nothing relative to the nature of the commerce to be benefited beyond that

which is to be found in the annual report. I am promised written statements upon such matters by those interested, and I am convinced that from what I have had presented to me and from personal observation that the improvement is a worthy one and should be made.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

FORT BANKS, MASS., *August 24, 1900.*

Respectfully submitted to the Chief of Engineers.

More than \$400,000 has been expended by the United States in trying to improve this river, yet the controlling depth is now only about what it was when work was commenced.

The stream is worthy of improvement if it can be done at reasonable cost. I recommend that the survey be made if the funds recommended to be allotted by the district engineer are available.

Very respectfully,

PETER C. HAINS,
Colonel Engineers, Division Engineer,
Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 30, 1900.

Respectfully submitted to the Secretary of War.

This report relates to a preliminary examination of Appomattox River, Virginia (full text of item quoted within), required by the provisions of the emergency river and harbor act of June 6, 1900.

The local engineer is of opinion that it is entirely feasible to effect the improvement of the river as contemplated in the act by an expenditure within the limits of due economy, and that the work is one worthy of being undertaken by the General Government.

The division engineer is of opinion that the stream is worthy of improvement if it can be done at reasonable cost.

I recommend that the local engineer be directed to prepare a plan and estimate of cost of improvement proposed, from the results of which an opinion may be formed as to the amount of improvement that may be justified by the commerce involved.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
August 31, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

SURVEY OF APPOMATTOX RIVER, VIRGINIA, WITH A VIEW TO THE DEFLECTION OF THE RIVER AT PETERSBURG.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., November 23, 1900.

GENERAL: In obedience to instructions contained in letter from your office of September 5, 1900, I have the honor to report as follows as to survey of—

Appomattox River: Resurvey and estimate for the deflection of the river at Petersburg.

The deflection of the river at Petersburg is not a new subject. It has been under consideration for a long time. Capt. Thomas Turtle, Corps of Engineers, United States Army, reported upon it in 1882, Lieut. G. J. Fiebeger, Corps of Engineers, United States Army, submitted a report on same subject in 1889, and in 1893 Lieut. Edward Burr, Corps of Engineers, United States Army, made further report. In all of these reports the feasibility is admitted and they differ mainly upon the methods to be employed.

Since these reports were submitted some slight changes have occurred in the extension of the tracks of the Richmond and Petersburg Railroad and the construction of roadways for vehicles to pass beneath the tracks.

The examination has been confined to verification of previous surveys, and nothing has been found to warrant the presentation of new maps, those submitted with Lieutenant Fiebeger's report in 1889 being sufficiently correct for purposes of estimate and description of project.

The Appomattox River at Petersburg forms the harbor, and the difficulties attending its maintenance are due to the volumes of sand deposited in the harbor by every occurring freshet. The efforts to secure a useful depth for navigation as far as the bridge across the stream at Petersburg have been rendered ineffective in consequence of the very considerable constriction of the channel at the bridge or upper limit of the harbor by a rock ledge which crosses the river at this point, which impedes the flow of the stream to such an extent that sand borne by the current above this point is dropped below it, a condition which is augmented by the action of the tide at certain stages.

The river being a tidal one within the limits of the survey, the navigable requirements can be served without any dependence upon the volume of water flowing in the stream above Petersburg, and, under the circumstances at present prevailing, would be better if this flow of water was entirely cut off.

The situation admits of such a solution.

It is proposed to divert the water above the bridge so as to cause the river to pursue a course away from the navigable channel and deposit the sand carried by it in a location where it may do some good rather than be a nuisance as at present.

To accomplish this object I respectfully recommend that a dam be constructed at the bridge of such height that at extreme flood stages the water may escape over it. To then open up the old unused channel as previously recommended.

To accommodate the wagon traffic, which would be interrupted by excavating for the new channel, a pile bridge can be built at the foot of Second street to connect with the Richmond and Petersburg turn-pike.

Where the railroad crosses this proposed new channel the embankment will have to be cut and a bridge constructed, giving a clear waterway of not less than 240 feet.

The diking below the island to confine the flood water to the new channel can be best constructed with the material removed during the excavation of the new channel.

Estimate.

Excavating channel 200 feet wide to low water, 351,000 cubic yards, 20 per cent.....	\$70, 000
Railroad bridge	36, 300
Dam and waste weir.....	45, 000
Dike, 249,000 cubic yards, 20 per cent.....	49, 800
Riprap or other protection	10, 000
Pile bridge for roadway.....	10, 000
Condemned property	10, 000
20-inch cast-iron pipe, valve, grating, etc.....	1, 000
Engineering and contingencies, 15 per cent.....	34, 815
Total	266, 915

The cost of maintenance for several years would amount to about \$6,000 per year.

I believe the project can be carried out for the sum named, and I believe that the improvement is worthy, for the reasons set forth in the accompanying letter from a committee of prominent citizens of Petersburg, to which attention is earnestly invited.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 28, 1900.

Respectfully submitted to the Chief of Engineers, U. S. A.

More than \$1,000,000 have been expended in attempts to improve the Appomattox River in order to give the relief to commerce that its unquestionable importance demands. Of this sum the city of Petersburg has expended over \$600,000. The object has been to obtain and maintain a 12-foot navigation, and to-day there are scarcely 6 feet. Efforts in the past toward improving the river have been mostly confined to dredging and regulating works. These might have given the desired navigation were it not for the deterioration of the channel, caused in great part by the freshets coming from the river above the head of navigation at Petersburg.

This plan of diverting the upper waters of the river at a point near Petersburg is feasible, and in my judgment will ameliorate the existing conditions, although it will not accomplish the result of entirely ridding the navigable portion of the river of sediment deposited by freshets from tributaries like Lieutenant Run and others that flow into it. In addition there will be deposits from the streets of Petersburg and from the watershed. Even then, in my opinion, the scheme is practicable only if operations can be carried on expeditiously and continuously to completion, and the cost of annual maintenance promptly provided after the work is finished.

I am of the opinion that the estimate is too small; that the total cost of the improvement will reach a sum not less than \$400,000, with an annual cost of \$5,000 for maintenance. A channel of larger dimensions to carry off freshets must, in my opinion, be provided. The commercial interests involved justify it.

In my opinion this work is worthy of being undertaken by the General Government, provided the full amount of \$400,000 is appropriated at one time, in order that the work may be carried out free from the dangers of interruption by large freshets.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

LETTER FROM PROMINENT CITIZENS OF PETERSBURG, VA.

PETERSBURG, VA., October 10, 1900.

MAJOR: The United States Government has expended over \$400,000 and the city of Petersburg over \$600,000 in the improvement of the Appomattox River, and the result shows that no permanent benefit can be hoped for under the plan that has been followed.

Every freshet brings down from the upper country sand and mud that is deposited as soon as it reaches the head of the tide water, thus filling our harbor and the channel with shoals and bars. The more the forests are cut down and the country opened up for agriculture, the worse this wash becomes and the greater the quantity of sand to be removed by the dredge. In fact, it is now a serious question with us where to put this sand, so great is the quantity that we have had to dredge out. The removal of this deposit entails an annual expense of from ten to twenty thousand dollars to maintain an indifferent channel, with no certainty that it will not be closed by one night of hard rain.

We are now seeking to maintain 9 feet of water, as less would be useless, but unless some relief can be obtained we will be forced to abandon the river altogether and regard the money so far invested as thrown away. One fact has been established, and that is that the only obstacle to our success is the sand brought down from the upper country; and one remedy is clearly pointed out—prevent this sand from entering the harbor and channel. This can be done by deflecting the freshet water at a point above our harbor into an old unused waterway to the north and west of our present channel. To do this, Major Casey, the United States engineer, estimated would require \$200,000, and he strongly urged in his report last year that this amount be appropriated for the purpose. He said to our committee that waited on him to present this matter that the work ought to be done on the ground of economy, as the sum now required annually for temporary mitigation would represent an extortionate rate of interest on the amount needed to give permanent and absolute relief.

Certain able and successful advocates, two thousand years ago, in presenting the claim of a Roman centurion, thought it not unbecoming to plead that he was worthy of kindness at the hands of the Master, and stated that he had built them a synagogue; and so it is not inappropriate that we call to your attention the worthiness of our city, in that she has, under the direction of your engineers, with lavish hand expended her money to build that which without your help now will be the costly mausoleum of her fondest hopes for maritime importance.

And now that you may see the use that Petersburg has for cheap water transportation, we will mention a few of the many facts that we have at hand. The annual internal-revenue receipts at the office of Col. James D. Brady, in this city, amount to nearly \$4,000,000. We receive 15,000,000 pounds of leaf tobacco a year. Ten million pounds are manufactured, and of this 8,000,000 pounds are exported, being four-fifths, or 80 per cent, of the total amount exported from the whole of the United States. There are made here 1,200 trunks and 1,500 traveling bags and suit cases a day. We make silks from the cocoon, employing 1,200 hands, and shipping the whole product to New York.

This is the Spanish peanut market of the world. The crop handled here and shipped amounts to about \$2,000,000. We manufacture 20,000 tons of guano, worth about \$15 a ton. One factory here makes 3,000 pairs of pants a week, and sells its output from New York to New Orleans. Another turns out 60,000 dozen pairs of

hose a year, and the industry is young. Our sumac, bark and extract works handle some 6,000,000 pounds of sumac and 4,000 tons of bark. We ship over \$1,000,000 worth of shoes a year, from the Potomac to the Gulf, and the product of our grain mills is worth about the same amount. Our cotton mills consume nearly 10,000 bales of cotton a year, and ship much of their output to China.

We have granite in inexhaustible quantities, and our quarries are ready with every facility to place it on suitable vessels for transporting it as soon as such vessels can come for it. There is received here 50,000,000 feet of lumber, and this could be doubled if larger vessels could reach our wharves to load. The commerce of our port is about 200,000 tons, worth about \$1,500,000. Of the 136 different kinds of manufacturing enterprises in this city we have mentioned only a few, and of these lumber is the only one that now finds its outlet by water. Other manufactured products will use this mode of transportation as soon as coastwise vessels can come to our wharves. We might mention that thousands of the shot and shell for the Government are made by a foundry here, and that a light-ship to be fully equipped as a steamer is now being built in our shipyard, but these facts are already known to you.

Very respectfully,

CARTER R. BISHOP,
Chairman River and Harbor Committee.

N. T. PATTERSON, Jr.,
President Common Council.

BARTLETT ROPER,
President Chamber of Commerce.

CHARLES HALL DAVIS,
President Young Men's Business Association.

Maj. JAMES B. QUINN,
Corps of Engineers, U. S. A.

K 14.

EXAMINATION AND SURVEY OF PAGAN RIVER, VIRGINIA.

[Printed in House Doc. No. 88, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 26, 1900.

SIR: I have the honor to submit the accompanying copies of reports dated August 23 and November 19, 1900, by Maj. James B. Quinn, Corps of Engineers, upon preliminary examination and survey, respectively, of Pagan River from Smithfield, Va., to James River, with a view to securing a channel 80 feet wide and 10 feet deep at mean low tide, or such improvement as may be found expedient, made in accordance with requirements of the emergency river and harbor act of June 6, 1900.

Major Quinn states that a channel of less than 80 feet width and 8 feet depth would be of little service. The estimated cost of a channel 8 feet deep, the width remaining the same as it is, is \$28,870, and he states that the locality is worthy of improvement to this extent.

The division engineer, Col. Peter C. Hains, Corps of Engineers, in forwarding the report on survey to this office, states that, for reasons given, he is of opinion that the river is not worthy of improvement to the extent indicated.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF PAGAN RIVER FROM SMITHFIELD, VA., TO JAMES RIVER, WITH A VIEW TO SECURING A CHANNEL 80 FEET WIDE AND 10 FEET DEEP AT MEAN LOW TIDE, OR SUCH IMPROVEMENT AS MAY BE FOUND EXPEDIENT.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., August 23, 1900.

GENERAL: In accordance with the instructions contained in the letter from your office dated July 3, 1900, relative to preliminary examinations authorized by the act of June 6, 1900, and assigned to me for investigation, I have the honor to submit the following report as to—

Pagan River from Smithfield, Va., to James River, with a view to securing a channel 80 feet wide and 10 feet deep at mean low tide, or such improvement as may be found expedient.

The Pagan River enters the James River on the south side about 7 miles above Hampton Roads, and extends some distance beyond Smithfield, which is 5 miles from the mouth of the stream.

Under appropriations aggregating \$10,000 for "Improving Pagan Creek, Virginia," in the acts of June 14, 1880, and March 3, 1881, a bar at the mouth and two bars within the creek were dredged to a depth of 8 feet at mean low water. Since then these channels have deteriorated, and at the present time vessels drawing $6\frac{1}{2}$ feet have considerable trouble in reaching Smithfield on low water.

From Smithfield to the nearest railroad is 15 miles, and the nearest wharf on the James River is about 12 miles, so that Pagan River is the only practical direct outlet for the products of that place and the fertile territory in close proximity thereto.

In addition to two steamboats, each making a trip daily between Norfolk and Smithfield, there are several schooners which are regularly employed in transporting lumber, and quite a large fleet of small craft in service on the river. All the information which I have been able to obtain as to the commerce is appended. From what I can learn, the commerce is somewhat general in character.

To attain a channel of the dimensions stipulated in the item covering the preliminary examination will require dredging over distances aggregating about 14,000 feet—8,000 feet within the creek and 6,000 feet from the mouth out to the 10-foot contour in the James River. The latter section, if dredged only 80 feet wide, would have to be well buoyed to enable sailing masters on vessels bound in to determine the exact position of the channel.

I am of the opinion that the present and prospective demands of commerce warrant the dredging of a channel 80 feet wide and 10 feet deep at mean low water in Pagan River, Virginia, from the James River to Smithfield. A survey will cost \$450, which amount will have to be provided from the appropriation for "Emergencies in river and harbor works" in the act of June 6, 1900.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 27, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

This stream is deemed worthy of improvement by the United States to a limited extent.

An 8-foot navigation seems to have accommodated all the commerce in the past, and a survey may develop that 8 feet may be all that is justified under the alternative provided by the law in the words "or such improvement as may be found expedient."

It is recommended that a survey be made if funds are available for the purpose.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 6, 1900.

Respectfully submitted to the Secretary of War.

This report relates to a preliminary examination of Pagan River, Virginia (full text of item quoted within), required by the provisions of the emergency river and harbor act of June 6, 1900.

In the opinion of the local engineer the present and prospective demands of commerce warrant the dredging of a channel in the river 80 feet wide and 10 feet deep at mean low water from the James River to Smithfield.

Inviting attention to the views of the division engineer, in first indorsement hereon, I recommend that a survey be made in accordance with his views, from the results of which an opinion may be formed as to the amount of improvement that may be justified by the commerce involved.

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

[Third indorsement.]

WAR DEPARTMENT,
September 8, 1900.

Approved as recommended by the Chief of Engineers.

G. D. MEIKLEJOHN,
Acting Secretary of War.

LETTER OF HON. C. F. DAY, MAYOR OF SMITHFIELD.

SMITHFIELD, VA., *August 6, 1900.*

DEAR SIR: In reply to yours of the 30th ultimo, I beg to say that between 300,000 and 400,000 bags of nuts are handled at this place annually, representing a value of about \$800,000 to \$1,000,000. Our creek, or river, is gradually filling up and all classes of vessels find great difficulty in getting to and from this place. In addition to the peanuts there are large timber and other interests dependent on a proper depth of water to successfully carry on their business.

Very truly,

C. F. DAY,
Mayor, Corporation of Smithfield.

Maj. JAMES B. QUINN.

SURVEY OF PAGAN RIVER FROM SMITHFIELD, VA., TO JAMES RIVER, WITH A VIEW TO SECURING A CHANNEL 80 FEET WIDE AND 10 OR 8 FEET DEEP AT MEAN LOW TIDE.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., November 19, 1900.

GENERAL: In pursuance with instructions contained in letter from your office, dated September 13, 1900, regarding the survey of Pagan River, Virginia, I have the honor to report as follows:

Pagan River flows into the James River about 9 miles above the mouth of the Nansemond River. It is navigable for vessels of light draft as far as Smithfield.

The Old Dominion Steamship Company has two vessels plying between Norfolk and Smithfield, each of which makes a daily trip, and, besides these, there are a number of small sailing craft which find occupation in carrying oysters, garden truck, etc., to the cities of Norfolk, Portsmouth, and Newport News. The principal trade is in oysters and peanuts and general merchandise. The steamship business in and out of Pagan River is approximately 24,000 tons annually. The depth of water in the river is influenced by the tides for some distance above Smithfield. The freshets, due to heavy rains, are not important, aside from the fact that more or less sand is carried into the channel, forming bars, which are obstructive to navigation.

Under appropriations made by Congress in 1880 and 1881 some dredging to secure a depth of 8 feet in the channels over the shoalest places (in Pagan Creek) was made, and some remains of channels dredged under these appropriations are still in evidence.

A bar exists at the mouth, which it is hardly possible to prevent forming from time to time without an expenditure for permanent revetment entirely out of proportion to the interests to be benefited.

The channels through the inner bars are somewhat more lasting. From time to time the cleaning out of the artificial channels will be necessary.

The act calls for the examination of "Pagan River from Smithfield, Va., to James River, with a view to securing a channel 80 feet wide and 10 feet deep at mean low tide, or such improvement as may be found expedient."

The examination shows five bars which will require dredging to give the required depth and width:

	Cubic yards.
Bridge Shoal.....	16, 000
Between Bridge Shoal and Wrights.....	19, 200
Wright's Bar.....	43, 200
Bob Shoal.....	48, 000
Mouth of creek.....	97, 000
Total in place.....	223, 400

If a center cut 25 feet wide be removed in scows and two side cuts be overcast, this dredging will cost:

75,000 cubic yards, at 20 cents.....	\$15, 000
148,400 cubic yards, at 12 cents.....	17, 808
	32, 808
Contingencies.....	3, 280
Total.....	36, 088

If the depth is reduced to 8 feet, the width remaining the same as it is, the cost of improvement would be \$28,870, which amount it is believed is as much as the interests involved would warrant.

The dredged channels may last for ten years, but the bar at the mouth is subject to great changes by freshets in the James River. A channel of less than 80 feet width and 8 feet depth would be of little service.

I am unable to present any considerable array of statistics upon which to base a satisfactory representation for the expenditure of so large a sum as \$28,870 for the improvement of this (creek) river, owing to the apparent indifference of parties addressed to furnish this information. I am inclined to believe, however, that if the commerce is sufficient to warrant the maintenance of two steamers in this trade that with greater conveniences in navigation the commerce will increase, and that the improvement to the extent of \$28,870 is worthy.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 21, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

The absence of statistics of commerce involved, owing to the indifference of the people who would be supposed to be interested if the improvement of the river was needed, seems to indicate that the commerce is not of much importance.

In my opinion a 10-foot navigation is not required to accommodate either the present or prospective demands of commerce. The cost of an 8-foot channel would be about \$29,000.

An 8-foot channel was dredged at this place about twenty years ago, and the district engineer reports that some remains of it are still in evidence. This seems to indicate that about \$1,500 per annum will be required for maintenance of an 8-foot improvement. This, capitalized at 3 per cent, would represent an expenditure of \$50,000.

I am of the opinion that the river is not worthy of improvement to that extent.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division

K 15.

EXAMINATION AND SURVEY OF CHESCONNESSEX CREEK, VIRGINIA.

[Printed in House Doc. No. 87, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, November 23, 1900.

SIR: I have the honor to submit the accompanying copies of reports dated August 8 and November 9, 1900, by Maj. James B. Quinn, Corps

of Engineers, upon preliminary examination and survey of Chesconnessex Creek, an estuary of the Chesapeake Bay running up into land on the western side of Accomac County, Va., with a view to dredging the same, made in compliance with requirements of the emergency river and harbor act of June 6, 1900.

Major Quinn presents a plan for improvement by dredging a channel 130 feet wide and 8 feet deep at mean low water through the bar below Chesconnessex Wharf and to provide a turning basin of a similar depth alongside the wharf, all at an estimated cost of \$5,204. In his opinion the locality is worthy of improvement by the General Government to the extent indicated, and his views are concurred in by the division engineer, Col. Peter C. Hains, Corps of Engineers.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF CHESCONNESSEX CREEK, VIRGINIA,
WITH A VIEW TO DREDGING THE SAME.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., August 8, 1900.

GENERAL: In compliance with the instructions contained in the letter from your office, dated July 9, 1900, in connection with the preliminary examinations authorized to be made under the provisions of the emergency river and harbor act approved June 6, 1900, and assigned to me for investigation and report, I have the honor to submit the following as to the locality described in the item of the above-mentioned act quoted below:

Chesconnessex Creek, an estuary of the Chesapeake Bay, running up into land on the western side of Accomac County, Virginia, with a view to dredging the same.

The present channel depth of the before-mentioned creek is ample from its mouth to a point about 4 miles above, or to Chesconnessex Wharf, where for about 500 feet a bar exists which has only a depth over it of 5 feet and a width of only 40 feet. Being located in a bend of the stream, it is quite difficult to maneuver vessels at low tide without grounding. The depth of water on this bar is gradually decreasing, and the company operating the steamboat on the creek have threatened to abandon the route. Should this be carried into effect, the regular means of shipment would be practically destroyed.

The commerce seems to be purely local, and divided between a regular line steamer, which runs to Baltimore, making about four trips per week, and a large number of small vessels sailing to various ports.

It would be a hardship to the shippers located in this vicinity if the steamer line to Baltimore should be discontinued, necessitating the hauling of their freight a distance of fully 7 miles to reach a regular point of shipment, thus putting them to greater expense in reaching a market for their products.

The commerce in 1899 was valued at about \$36,000, as the appended statement will indicate. The cost of the slight improvement desired

will not be large, and the conditions existing seem to justify its being made.

I believe Chesconnessex Creek, Virginia, to be worthy of improvement. Such a survey as is necessary will cost about \$100, which amount will have to be provided from the funds appropriated by the act of June 6, 1900.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 10, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

In my opinion this stream is worthy of improvement to a very limited extent, and as a survey to determine the cost is estimated at only \$100, it is recommended that the survey be made, after which the question of worthiness of the bar for improvement can be more readily determined

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 17, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Chesconnessex Creek, Virginia (full text of item quoted within), made to comply with the requirements of the emergency river and harbor act of June 6, 1900.

It is the opinion of the local officer that the creek is worthy of improvement, and the division engineer is of opinion, expressed in preceding indorsement, that it is worthy of improvement to a very limited extent, and that the question of worthiness can more readily be determined after a survey—which he recommends—shall have been made.

I recommend that a survey be authorized, in accordance with the views expressed by the division engineer.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
August 18, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

Commercial statistics.

Articles	Quantity	Value.
OUTGOING.		
Potatoes.....barrels	10,000	\$12,500
Strawberries.....crates	1,200	2,100
Onions.....bushels	1,400	650
Oysters.....barrels	150	275
Crabs.....boxes	75	600
Fish.....do.	125	625
Total valuation.....		16,850
INCOMING.		
Ice, crates, boxes, and burlaps.....		600
Merchandise.....		19,000
Total valuation.....		19,600
Total value of commerce during year 1899.....		36,450

SURVEY OF CHESCONNESSEX CREEK, VIRGINIA, WITH A VIEW TO
DREDGING THE SAME.

UNITED STATES ENGINEER OFFICE,

Norfolk, Va., November 9, 1900.

GENERAL: In compliance with the instructions contained in the letter from your office, dated August 25, 1900, advising me of the action taken on my report upon a preliminary examination of Chesconnessex Creek, Virginia, made under the provisions of the emergency river and harbor act of June 6, 1900, I have the honor to state that under my direction a survey of the said creek, in the vicinity of Chesconnessex Wharf, was made between September 4 and 6, 1900, by Mr. J. P. White, assistant engineer. A full description of the creek may be found in the report upon the preliminary examination. The accompanying tracing¹ shows the present depths on the bar just below the wharf and alongside of the structure, where a turning basin is suggested.

The draft of vessels navigating the creek as far as the wharf at Chesconnessex varies from 3 to $7\frac{1}{2}$ feet, so that at low water those over 5 feet draft would be compelled to cross the bar at or near high water. At the wharf the area of deep water is limited, and in some instances vessels can not turn around when the tide is low. The principal shipments are perishable products of the surrounding neighborhood, and it is evident that any delay results in some loss to the shippers.

The statistics presented with my preliminary report represented, as accurately as it is possible to ascertain, the present commerce of the creek. I am informed that during the present year 25,000 bushels of seed oysters have been planted in the creek, and it is the expectation that this industry will show a large increase in shipments in the present season over previous years.

To dredge a channel about 500 feet long, 130 feet wide, and 8 feet deep at mean low water through the bar below Chesconnessex wharf, and to provide a turning basin of a similar depth alongside the

¹ Not printed.

wharf, as shown on the tracing, will cost approximately \$5,204, as follows:

Bar:

Removing and depositing 11,742 cubic yards, scow measurements, of material (mostly sand), at 33 cents per cubic yard..... \$3, 874. 86

Turning basin:

Removing and depositing 2,594 cubic yards, scow measurement, of material (mostly sand), at 33 cents per cubic yard..... 856. 02

Contingencies, inspection, etc., 10 per cent..... 4, 730. 88
473. 08

Total 5, 203. 96

I am of the opinion that Chesconnessex Creek is worthy of improvement to the extent indicated herein.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 13, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

In my indorsement on the report of the preliminary examination of this stream I gave it as my opinion that it was worthy of improvement to a very limited extent.

The district engineer estimates that an 8-foot channel, 130 feet wide, can be dredged for \$5,204, and this seems ample for the commerce interested, which consists of a regular line of steamers making four trips a week, and a large number of small sailing vessels.

I concur in the opinion of the district engineer that the creek is worthy of improvement by the General Government to the extent indicated in this report.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

APPENDIX L.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA.

REPORT OF CAPT. E. W. VAN C. LUCAS, CORPS OF ENGINEERS,
OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30,
1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|--|---|
| 1. Ocracoke Inlet, North Carolina. | 10. New River, North Carolina. |
| 2. Fishing Creek, North Carolina. | 11. Black River, North Carolina. |
| 3. Pamlico and Tar Rivers, North Carolina. | 12. North East (Cape Fear) River, North Carolina. |
| 4. Contentnia Creek, North Carolina. | 13. Cape Fear River above Wilmington, North Carolina. |
| 5. Trent River, North Carolina. | 14. Cape Fear River at and below Wilmington, North Carolina. |
| 6. Neuse River, North Carolina. | 15. Town Creek, North Carolina. |
| 7. Inland waterway between Newbern and Beaufort, North Carolina. | 16. Removing sunken vessels or craft obstructing or endangering navigation. |
| 8. Harbor at Beaufort, North Carolina. | |
| 9. Inland waterway between Beaufort and New River, North Carolina. | |

EXAMINATIONS AND SURVEYS.

- | | |
|---|--|
| 17. Waterway from South Mills, North Carolina, to and including Ocracoke and Beaufort inlets. | 19. Trent River, North Carolina. |
| 18. Scuppernong River, North Carolina. | 20. Wilmington Harbor and Cape Fear River, North Carolina. |
| | 21. Brunswick River, North Carolina. |

HARBOR LINES.

22. Pamlico River at Washington, North Carolina.
23. Cape Fear River at Southport, North Carolina.
-

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., July 18, 1901.

GENERAL: I have the honor to submit herewith * * * my annual report for the year 1901 for river and harbor works * * * .

Very respectfully, your obedient servant,

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

L I.

IMPROVEMENT OF OCRACOCKE INLET, NORTH CAROLINA.

For description and previous history see annual report for 1900, pages 265 and 1793.

Work during the year has been limited to examinations and surveys in September and October, 1900, in connection with survey for proposed inland waterway 16 feet deep to connect Dismal Swamp Canal and Beaufort Inlet with outlet at Ocracoke Inlet. The results of this survey at Ocracoke show no material changes since the survey of May, 1900, excepting that shoaling at Beacon Island Slough has continued, the governing depth being $4\frac{1}{2}$ feet, a decrease of 6 inches since May, 1900.

Since the redredging of Wallace Channel to 9 feet depth was completed in 1896 shoaling of dredged cuts has been continuous, and the practicable depth by this route ($4\frac{1}{2}$ feet) is only one-half the project depth. The governing depth over Ocracoke Shoals is now 7 feet at high water, by the Teaches Hole-Swash route, which is used almost exclusively by the few vessels passing through the inlet.

The available balance should be reserved for necessary surveys to record any marked change on ocean bar or inside channels, so that as complete as possible a history of the natural changes at this locality will be available whenever its improvement is resumed. No additional appropriation is recommended at present.

This inlet is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1900, balance unexpended	\$15,701. 53
June 30, 1901, amount expended during fiscal year	6,665. 66
July 1, 1901, balance unexpended	9,035. 87
Amount (estimated) required for completion of existing project	(¹)

APPROPRIATED.

March 20, 1826, to March 3, 1837	\$133,750. 00
September 19, 1890	90,000. 00
July 13, 1892	15,000. 00
	238,750. 00
Less amount carried to surplus fund	17. 60
	238,732. 40

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Tons.
Lumber	3,976
Coal	93
Rice	60
Fruits	90
Molasses	59
General merchandise	240
Miscellaneous	382
Total	4,900

¹ Project completed in 1896; dredged channels since deteriorated; can be redredged at estimated cost of \$40,000.

Freight transported.

Calendar year ending December 31—

1890, estimated	tons..	15,000
1891, estimated	do..	15,000
1892		(¹)
1893		(¹)
1894		(¹)
1895, estimated	tons..	30,223
1896, estimated	do..	50,000
1897, estimated	do..	43,741
1898		(¹)
1899, for six months ending December 31		4,457

Class of vessel.	Number.	Aggregate net tonnage.	Draft.
Sailing vessels.....	25	2,841	<i>Fect.</i> 4 to 10
Steamers	17	1,070	5 to 10
Total	42	3,911	.....

L 2.

IMPROVEMENT OF FISHING CREEK, NORTH CAROLINA.

For previous history, see annual report for 1900, pages 266 and 1796.

During the year work of clearing the stream under project of 1896 was carried on when stage of water would permit until completed, on March 1, 1901, there being removed, between twenty-fourth and thirty-second mileposts, 46 stumps, 1 log, 958 snags, and 392 trees from the channel, and 32 overhanging trees from the banks.

The above work completed the project, and there is now a cleared channel from the mouth up to the Wilmington and Weldon Railroad bridge, a distance of 40 miles. After its completion, the plant was taken to the depot at Newbern and laid up.

Navigation of this stream has been restricted to the 17½ miles between the mouth and Beach Swamp, above which point it is impracticable. The hoister working above that point had to remain in the creek about nine months in order to do two months' work, the rest of the time lying idle because the water was so low that it could not be moved.

The commerce below Beach Swamp amounted to 4,620 tons, an increase over last year of about 15 per cent.

It is recommended that future appropriations for maintenance be restricted to the 17½ miles below Beach Swamp.

The improvement has been in the local charge of Assistant Engineer S. F. Burbank.

This creek is in the collection district of Pamlico, N. C.

¹ No estimate.

1486 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Money statement.

July 1, 1900, balance unexpended	\$1, 898. 81
June 30, 1901, amount expended during fiscal year	1, 860. 97
July 1, 1901, balance unexpended	37. 84
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATED.

September 19, 1890	\$10, 000
July 13, 1892	5, 000
March 3, 1899	7, 750
Total	22, 750

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	26½	General merchandise	9
Cotton seed	383	Fertilizers	223
Cotton-seed meal	125	Peanuts	343
Cotton-seed hulls	15	Total	4, 619½
Wood	120		
Timber	3, 375		

Increase since last year, 617½ tons. Transportation lines established during year, none.

Freight transported.

Calendar year ending December 31—	Tons.
1896	1, 000
1897	2, 460
1898	3, 542
1899	4, 002

Statement of vessels navigating Fishing Creek, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during year.
Steamer	1	46	<i>Ft. In.</i> 1 8	20

There was also one flat that made a number of trips during the year.

L 3.

IMPROVEMENT OF PAMLICO AND TAR RIVERS, NORTH CAROLINA.

[One river, called the Pamlico below and the Tar above Washington.]

For previous history, see annual report for 1900, pages 267 and 1798.

Work during the year has consisted in dredging, of pursuance of project, to obtain 9 feet depth to Washington and 3 feet depth to Greenville, and of snagging to maintain cleared channel between Washington and Tarboro.

The dredging consisted of the removal of 1,710 cubic yards from the cut below Washington and 1,313 cubic yards from three shoals between the nineteenth milepost and Greenville. Dredging was then suspended because of lack of funds.

As a result of the dredging just below Greenville, the project depth of 3 feet has been obtained to that point, an increase of 1 foot during the year. This portion of the river is reported by boatmen to be in better condition than ever before.

Snagging for maintenance has been carried on between Washington and Tarboro by the removal from the channel of 58 snags, 13 stumps, 26 logs, and 27 trees, and from the banks 52 overhanging trees, at a cost of \$819.66.

Above Greenville the project depth of 20 inches does not exist, the jetties having deteriorated for lack of maintenance. The governing low-water depth above Greenville is about 15 inches and this part of the river is navigable only during the high stages.

The small available balance will be used up in caring for plant stored at depot. Additional appropriations should be applied to completion of dredging just below Washington to obtain project depth of 9 feet, and also to the maintenance of the present channel between Washington and the mouth of Fishing Creek, at the rate of \$6,000 annually.

The commercial statistics show a tonnage for 1900 of 613,895, an increase over 1899 of 106,414 tons.

This improvement has been in local charge of Assistant Engineer S. F. Burbank.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1900, balance unexpended	\$2,651.23
June 30, 1901, amount expended during fiscal year	2,520.44
July 1, 1901, balance unexpended	130.79
Amount (estimated) required for completion of existing project	29,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$29,500.00
For maintenance of improvement	6,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	35,500.00

1488 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Appropriated for Pamlico and Tar rivers, North Carolina.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838..	\$10,000	\$10,000	August 5, 1886	\$5,000	\$58,000
August 14, 1876	15,000	15,000	August 11, 1888	10,000	68,000
May 3, 1879	6,000	21,000	September 19, 1890	10,000	78,000
June 14, 1880	9,000	30,000	July 13, 1892	10,000	88,000
March 3, 1881	8,000	38,000	August 18, 1894	10,000	98,000
August 2, 1882	10,000	48,000	June 3, 1896	5,000	103,000
July 5, 1884	5,000	53,000	March 3, 1899	15,000	118,000

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	4,396.75	Clams	5
Cotton seed	4,751.4	Rosin	5
Cotton-seed oil	621.5	Turpentine, crude	3
Cotton-seed meal	1,775	Wood	34,226
Cotton-seed hulls	926	Timber	186,448
Tobacco, leaf	33.5	Lumber	254,510
Rice, rough	151	Shingles	32,025
Grains	15,028.6	Machinery	348
Hay	2,931	General merchandise	28,749
Potatoes	6,126.6	Coal and minerals	4,939
Vegetables	195	Tar	8
Cattle	151	Peanuts	1,228
Horses	56	Canned oysters	537
Hogs	23	Empty barrels	532
Poultry	43	Oil, machinery, etc	51
Eggs	114.5		
Fish	2,292	Total	613,895
Oysters	29,508		

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1875	21,000	1895	183,226½
1890	277,832	1896	251,887½
1891	195,600	1897	363,513½
1892	107,097	1898	348,575½
1893	119,505	1899	507,481
1894	119,979		

Statement of vessels navigating Pamlico and Tar rivers, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Steamers and steam tugs	33	1,559	<i>Fect.</i> 3 to 9
Barges	43	12,900	6 to 7
Sloops, schooners, etc	50	1,750	2½ to 7½

L 4.

IMPROVEMENT OF CONTENTNIA CREEK, NORTH CAROLINA.

For previous history, see annual report for 1900, pages 268 and 1801.

Work during the year has consisted of maintenance by snagging between the mouth of the creek and Snow Hill, 46 large snags, 1 cord

of small snags, 15 stumps, 3 logs, and 43 trees being removed from the channel and 72 trees from the banks. Work was suspended in March and the small balance available reserved for care of plant.

The additional appropriation recommended should be applied to the maintenance of the present channel between the mouth of the creek and Speight's bridge.

The commerce during the year 1900 was 13,885 tons, about double that of the preceding year.

This improvement was in local charge of Assistant Engineer S. F. Burbank.

This creek is in the second collection district of North Carolina.

Money statement.

July 1, 1900, balance unexpended	\$912. 22
June 30, 1901, amount expended during fiscal year	700. 02
July 1, 1901, balance unexpended	212. 20
July 1, 1901, outstanding liabilities	48. 27
July 1, 1901, balance available	163. 93
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	4,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	\$10,000	\$10,000	September 19, 1890	\$7,000	\$52,000
August 2, 1882	10,000	20,000	July 13, 1892	7,000	59,000
July 5, 1884	5,000	25,000	August 18, 1894	10,000	69,000
August 5, 1886	15,000	40,000	March 3, 1899	2,000	71,000
August 11, 1888	5,000	45,000			

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Quantity.	Class of goods.	Quantity.
	<i>Tons.</i>		<i>Tons.</i>
Cotton	3,750	Fish	2
Cotton seed	800	Oysters	2
Cotton-seed oil	19	Wood	100
Cotton-seed meal	50	Timber	112
Tobacco, leaf	10	Lumber	200
Rice, rough	25	Shingles	4
Grains	50	Fertilizers	4,880
Hay	100	Machinery	10
Potatoes	60	General merchandise	3,600
Cattle	25	Coal and minerals	50
Horses	12	Peanuts	10
Hogs	5		
Poultry	5	Total	13,885
Eggs	4		

Number of passengers, 830.

Increase since last year, 7,291 tons. No transportation lines were established during the year.

Freight transported during the calendar year ending December 31—

	Tons.		Tons.
1890	125, 225	1895	53, 018
1891	55, 325	1896	16, 805
1892	17, 491	1897	2, 800
1893	21, 173	1898	3, 700
1894	19, 953	1899	6, 594

Statement of vessels navigating Contentnia Creek, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
Steamers.....	5	192. 64	<i>Feet.</i> 2 to 5	176

L 5.

IMPROVEMENT OF TRENT RIVER, NORTH CAROLINA.

For previous history see annual report for 1900, pages 268 and 1802.

Work during the year has consisted of maintenance by dredging and snagging, under the project of 1896, to maintain 3 feet depth and 30 feet width to Trenton. A cut 600 feet long, 30 feet wide, and 4 feet deep was dredged through two shoals just below Trenton, and the project depth restored. Snagging consisted of the removal of 12 snags, 4 stumps, 19 logs, and 2 trees from the channel, and 7 trees from the banks, with some tree trimming. The stream is in good condition and the project depth and width exist.

A preliminary examination made in September, 1900, showed a good 7-foot channel from Newbern to Polloksville. A survey of the river at Newbern was made in September, 1900, and an estimate of cost of dredging to 8 feet at mean low water submitted and printed in House Doc. No. 121, Fifty-sixth Congress, second session.

The present available balance will be expended in caring for plant now stored at depot. The additional appropriation recommended under present project should be expended in maintaining the existing channel to Trenton.

This improvement was in the local charge of Assistant Engineer S. F. Burbank.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1900, balance unexpended	\$1, 383. 18
June 30, 1901, amount expended during fiscal year	998. 86
July 1, 1901, balance unexpended	384. 32
July 1, 1901, outstanding liabilities	14. 50
July 1, 1901, balance available	369. 82

Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	2, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1879	\$7,000	\$7,000	August 11, 1888	\$5,000	\$50,500
June 14, 1880	10,000	17,000	September 19, 1890	5,000	55,500
March 3, 1881	5,000	22,000	July 13, 1892	5,000	60,500
August 2, 1882	10,000	32,000	August 18, 1894	4,000	64,500
July 5, 1884	10,000	42,000	June 3, 1896	2,000	66,500
August 5, 1886	3,500	45,500	March 3, 1899	2,500	69,000

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Quantity.	Class of goods.	Quantity.
Internal:	<i>Tons.</i>	Foreign and coastwise:	<i>Tons.</i>
Cotton	875	Potatoes	2,000
Cotton seed	8	Vegetables	240
Cotton-seed meal	80	Timber	60,192
Tobacco, leaf	3	Lumber	25,850
Grains	120	Shingles	900
Hay	200	Fertilizers	100
Potatoes	300	Machinery	100
Vegetables	40	Brick	675
Cattle	15		
Hogs	3	Total	100,057
Poultry	6		
Wood	1,600		
Timber	11,135	SUMMARY.	
Lumber	8,000	Internal	30,015
Shingles	40	Foreign and coastwise	100,057
Fertilizers	3,500		
General merchandise	3,100	Total	130,162
Coal and minerals	35		
Tar	143	Decrease of internal since last year	11,071
Peanuts	2	Increase of foreign and coastwise since last year	4,216
Crushed rock	900	Net decrease since last year	6,855
Total	30,105		

Number of passengers, 1,900.

No transportation lines established during the year.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1878	22,000	1895	142,422½
1890	89,985	1896	142,100½
1891	45,080	1897	142,788½
1892	59,576	1898	161,687
1893	34,649	1899	137,017
1894	28,055		

Statement of vessels navigating Trent River, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Steamers	21	1,540	<i>Fect.</i> 2 to 7½
Schooners, sloops, etc	137	5,840	2 to 7½
Barges	10	2,500	6 to 7½

L 6.

IMPROVEMENT OF NEUSE RIVER, NORTH CAROLINA.

For previous history see annual report for 1900, pages 269 and 1804.

Work during the year has consisted of dredging in pursuance of project to obtain 4 feet depth to Kinston and snagging for maintenance of cleared channel to Goldsboro. About 9,000 cubic yards of material were dredged from shoals between twenty-fourth and twenty-eighth mileposts, and the project depth of 4 feet has been extended to Biddles Landing, 27½ miles above Newbern. The snag boat removed from the channel 11 piles, 1 wreck, 58 snags, 49 stumps, 40 logs, and 55 trees, and from the banks 24 trees. Cost of the year's maintenance, \$1,767.12. Work was suspended in March and the small balance available reserved for care of plant.

The project depth of 8 feet to Newbern exists, but the project depth of 4 feet between Newbern and Kinston exists only for about half the distance. For nearly 25 miles below Kinston almost continuous deepening would be required to obtain this depth, and the cost would probably be out of all proportion to the value of the commerce to be benefited.

The small balance available will be expended in caring for plant stored at depot. The additional appropriation recommended should be expended in maintaining the present cleared channel between Newbern and Goldsboro.

A steamer recently built has started regular trips between Goldsboro and Newbern during the high stages of the river.

Of the 234,112 tons commerce reported for the year 1900, 183,842 tons is for that part of the river below Newbern.

This improvement has been in the local charge of Assistant Engineer S. F. Burbank.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1900, balance unexpended	\$3,562. 11
June 30, 1901, amount expended during fiscal year.....	3,439. 85
July 1, 1901, balance unexpended	122. 26
July 1, 1901, outstanding liabilities	5. 40
July 1, 1901, balance available	116. 86
{ Amount (estimated) required for completion of existing project	77,500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	6,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
June 18, 1878	\$40,000	\$40,000	August 11, 1888	\$15,000	\$247,500
March 3, 1879	45,000	85,000	September 30, 1890.....	20,000	267,500
June 14, 1880	45,000	130,000	July 13, 1892	15,000	282,500
March 3, 1881	30,000	160,000	August 18, 1894	7,000	289,500
August 2, 1882	30,000	190,000	June 3, 1896	7,000	296,500
July 5, 1884	20,000	210,000	March 3, 1899	10,000	306,500
August 5, 1886	22,500	232,500			

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Quantity.	Class of goods.	Quantity.
	<i>Tons.</i>		<i>Tons.</i>
Cotton	5,472	Clams	7,500
Cotton seed	2,575	Rosin	1,123
Cotton-seed oil	38	Turpentine, spirits	200
Cotton-seed meal	960	Wood	8,215
Cotton-seed hulls	505	Timber	60,402
Tobacco leaf	266	Lumber	61,331
Rice, rough	12	Shingles	280
Grains	5,505	Fertilizers	11,400
Hay	1,874	Machinery	4,230
Potatoes	3,214	General merchandise	21,455
Vegetables	1,690	Coal and minerals	2,438
Cattle	128	Tar	146
Horses	75	Peanuts	50
Hogs	5	Brick	675
Poultry	5	Staves	4
Eggs	68	Ice	153
Fish	30,615		
Oysters	1,503	Total	234,112

One hundred and eighty-three thousand eight hundred and forty-two tons of the above commerce was for that part of the river below Newbern. Decrease in commerce since last year, 100,029 tons. Two transportation lines established during the year.

Number of passengers, 16,380.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1877	75,000	1895	278,025½
1890	328,462	1896	297,092½
1891	267,650	1897	380,749½
1892	253,704	1898	342,815
1893	a 50,573	1899	334,141
1894	a 45,258		

a The statistics for 1893 and 1894 relate entirely to freight carried in bottoms on the river above Newbern. For the preceding years it covered all freight, both above and below Newbern, including rafts.

Statement of vessels navigating Neuse River, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			<i>Fect.</i>
Steamers	37	2,033	2 to 7½
Barges	23	6,501	6 to 7½
Schooners, sloops, etc	179	6,542	2 to 7½

L 7.

IMPROVEMENT OF INLAND WATERWAY BETWEEN NEWBERN AND BEAUFORT, NORTH CAROLINA (VIA NEUSE RIVER, CLUBFOOT CREEK, CLUBFOOT AND HARLOWE PRIVATE CANAL, HARLOWE CREEK, AND NEWPORT RIVER).

For previous history see annual report for 1900, pages 270 and 1806.

The condition of this waterway is about the same as last year. The only work done during the year has been a survey for estimating the cost of obtaining the project depth, made in May and June, 1901, the results of which have not yet been determined.

No additional appropriation is at present recommended. Should result of recent survey warrant, the available balance should be applied to continuation of existing project.

The statistics for 1900 show a commerce of 40,615 tons, an increase of 4,836 tons over the preceding year and the largest on record.

This waterway is in the collection districts of Pamlico and Beaufort, N. C.

Money statement.

July 1, 1900, balance unexpended	\$6, 772. 94
June 30, 1901, amount expended during fiscal year	317. 54
July 1, 1901, balance unexpended	6, 455. 40
July 1, 1901, outstanding liabilities	135. 18
July 1, 1901, balance available	6, 320. 22
Amount (estimated) required for completion of existing project	57, 000. 00

Appropriated.

Date.	Amount.	Aggregate.
August 2, 1882	\$10, 000	\$10, 000
August 5, 1886	10, 000	20, 000
August 11, 1888	15, 000	35, 000

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Quantity.	Class of goods.	Quantity.
	<i>Tons.</i>		<i>Tons.</i>
Hay	60	Shingles	20
Wood	100	Machinery	50
Timber	20, 810	General merchandise	75
Lumber	19, 600	Total	40, 615

Gain over last year, 4,836 tons. No transportation lines established during the year.

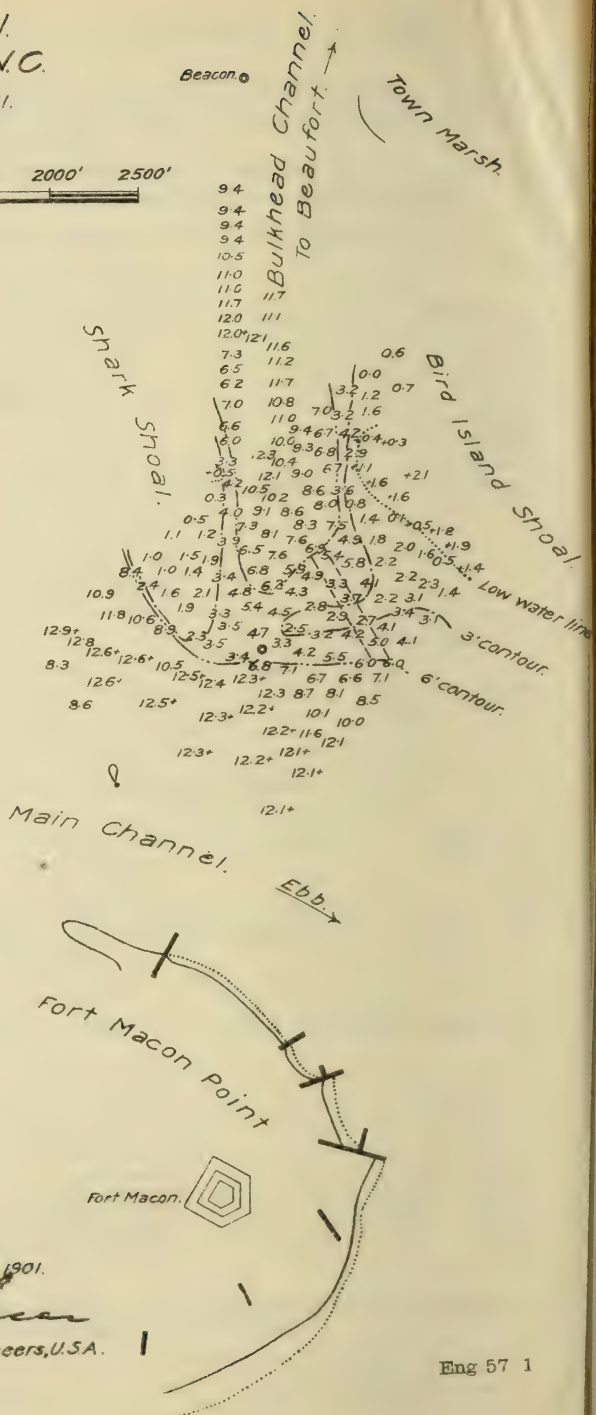
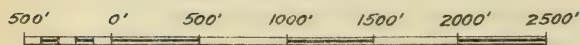
Freight transported.

Calendar year ending Dec. 31—	Tons.	Calendar year ending Dec. 31—	Tons.
1890	14, 000	1895	29, 737
1891	17, 390	1896 (estimated)	29, 737
1892	Not given.	1897	38, 897½
1893	Not given.	1898	20, 365
1894	Not given.	1899	35, 779

Statement of vessels navigating waterway between Newbern and Beaufort, N. C., during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			<i>Fect.</i>
Steamers	2	65	3. 5 to 4
Schooners, sloops, etc.	45	470	2 to 3. 5

Scale of Feet.



E. Ward Luce

Captain, Corps of Engineers, U.S.A.

L 8.

IMPROVEMENT OF HARBOR AT BEAUFORT, NORTH CAROLINA.

For previous history see annual report for 1900, pages 271 and 1806.

Work during the year has consisted of maintenance of jetties and sand fences at Fort Macon and Shackleford Point, under the project of 1896.

At Fort Macon 360 feet of new sand fence was built, 12,416 feet raised, 5,200 feet filled under, and 192 feet repaired. At Shackleford Point 406 feet of new sand fence was built, 6,860 feet raised, 10,755 feet filled under, and 745 feet repaired.

The result of the year's work confirms the opinion of the previous year, that the rigid sand fence is decidedly more effective than the old-style fence, and it has been exclusively used.

The channel leading to Beaufort Harbor over Bulkhead shoal has deteriorated, the governing low-water depth being only $3\frac{1}{2}$ feet, a loss of 1 foot as determined by the survey of June, 1901, of which map is submitted herewith.

A survey of the bar channel and the channel to Core Sound was made in October, 1900, in connection with survey for proposed waterway 16 feet deep between Dismal Swamp Canal and Beaufort Inlet, the result of which was reported in House Doc. No. 202, Fifty-sixth Congress, second session.

The small available balance will be used in caring for plant stored at depot. The additional appropriation recommended should be expended in maintenance of jetties and sand fences at Fort Macon and Shackleford Point, in accordance with the existing project. Shoaling of the channel to Beaufort over Bulkhead shoal is a serious obstacle to Beaufort business and should be remedied.

It has been impossible to obtain an accurate record of the year's commerce, but it is thought to be approximately the same as last year.

This improvement has been in local charge of Assistant Engineer S. F. Burbank.

Beaufort is a port of entry.

Money statement.

July 1, 1900, balance unexpended	\$1, 246. 65
June 30, 1901, amount expended during fiscal year	1, 147. 42
July 1, 1901, balance unexpended	99. 23
July 1, 1901, outstanding liabilities	42. 58
July 1, 1901, balance available	56. 65

{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1886	\$5,000	\$5,000	August 5, 1886	\$15,000	\$90,000
March 3, 1880	30,000	30,000	August 11, 1888	35,000	125,000
August 2, 1882	25,000	55,000	September 19, 1890	15,000	140,000
July 5, 1884	20,000	75,000	July 13, 1892	10,000	150,000
			June 3, 1896	5,000	155,000

COMMERCIAL STATISTICS.

Freight transported.

Calendar year ending Dec. 31—	Tons.	Calendar year ending Dec. 31—	Tons.
1880	25,000	1895	30,522½
1890	46,675	1896	38,807
1891	69,330	1897	34,930
1892	55,070	1898	38,781
1893	62,913	1899	39,356
1894	Not given.		

Statement of vessels navigating harbor at Beaufort, N. C., during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
Steamers	9	732	<i>Fect.</i> 2.5 to 13	336
Schooners and sloops	185	2,326	2.5 to 9	3,700

Nine steamers of 4½ to 13 feet draft visited the harbor once during the year, but are not included in the above.

L 9.

IMPROVEMENT OF INLAND WATERWAY BETWEEN BEAUFORT HARBOR AND NEW RIVER, NORTH CAROLINA.

For previous history see annual report for 1900, pages 271 and 1810.

No work was done during the year. The \$1,000 appropriated June 3, 1896, being too small for effective use, is held, except for expense of an examination of the waterway in June, 1900, until further appropriation is made. The condition of the waterway is about the same as last year, with ruling low-water depth of 2 feet.

The available balance, with the additional appropriation recommended, should be applied to redredging where deterioration has occurred and to continuation of project.

This waterway is in the collection district of Beaufort, N. C.

Money statement.

July 1, 1900, balance unexpended	\$975. 67
June 30, 1901, amount expended during fiscal year	20. 01
July 1, 1901, balance unexpended	955. 66
(Amount (estimated) required for completion of existing project	6, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$6, 500. 00
For maintenance of improvement	3, 000. 00
	9, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886.....	\$10, 000	\$10, 000	July 13, 1892.....	\$10, 000	\$40, 000
August 11, 1888.....	5, 000	15, 000	August 18, 1894.....	2, 500	42, 500
September 19, 1890.....	15, 000	30, 000	June 3, 1896.....	1, 000	43, 500

COMMERCIAL STATISTICS.

Freight transported.

Calendar year ending Dec. 31—	Tons.	Calendar year ending Dec. 31—	Tons.
1886.....	12, 250	1895.....	21, 874
1890.....	29, 332	1896.....	18, 022
1891.....	30, 240	1897.....	19, 193½
1893.....	32, 638	1898.....	21, 968½
1894.....	Not given.	1899.....	21, 248

Statement of vessels navigating waterway between Beaufort Harbor and New River, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
Steamers.....	2	76	<i>Feet.</i> 4	20
Schooners, sloops, etc	35	1, 890	2 to 10	650

L 10.

IMPROVEMENT OF NEW RIVER, NORTH CAROLINA.

For previous history see annual report for 1900, pages 272 and 1812.

No work has been done on this improvement during the year. The governing low-water depth is about 3 feet, through a tortuous channel around Cedar Bush Marsh.

The project of 1894, to obtain a channel 4 feet deep around Cedar Bush marsh, was completed in 1895 by means of training wall of wood, which has been destroyed by the teredo, the channel deteriorating to

its original condition. It is proposed to make a survey of this shoal in the near future to determine whether or not the available balance can be utilized to advantage.

The available balance should be held pending result of this survey, and in case of favorable showing should then be applied to obtaining project depth.

Money statement.

July 1, 1900, balance unexpended	\$3, 390. 87
June 30, 1901, amount expended during fiscal year	19. 61
July 1, 1901, balance unexpended	3, 371. 26

{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838..		\$50, 000	August 5, 1886.	\$10, 000	\$20, 000
August 2, 1882	\$5, 000	5, 000	August 11, 1888.	3, 000	23, 000
July 4, 1884	5, 000	10, 000	September 19, 1890	5, 000	28, 000
			July 13, 1892.	5, 000	33, 000

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Quantity.	Class of goods.	Quantity.
	<i>Tons.</i>		<i>Tons.</i>
Cotton	67	Turpentine, crude.	20
Cotton seed	60	Turpentine, spirits	193
Cotton-seed meal	23	Shingles	177
Grains	3	Fertilizers	403
Potatoes	15	Machinery	4
Vegetables	10	General merchandise	472
Fish	300	Coal and minerals	25
Oysters	35	Peanuts	314
Clams	27		
Rosin	1, 100	Total	3, 248

Freight transported.

Calendar year ending Dec. 31—	Tons.	Calendar year ending Dec. 31—	Tons.
1882	5, 000	1895	26, 771½
1890	17, 359	1896	7, 209
1891	23, 838	1897	2, 107
1893	1, 134½	1899	4, 610
1894	1, 147½		

Statement of vessels navigating New River, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			<i>Feet.</i>	
Steamers	3	113	2 to 4	100
Schooners	2	42	4	40

L II.

IMPROVEMENT OF BLACK RIVER, NORTH CAROLINA.

For previous history, see annual report for 1900, pages 273 and 1813.

Work during the year has consisted of maintenance by snagging, and there were removed from the channel 268 stumps and 353 snags, and from the banks 561 trees. The work was suspended in March and the small balance available reserved for care of plant.

The present low-water depths are 5 feet to Point Caswell, $2\frac{1}{2}$ feet to Hawes Narrows, and $1\frac{1}{2}$ feet to Clear Run. The river is navigable to Clear Run during high stages, aggregating about eight months annually.

The small available balance will be used for care of plant, and the additional appropriation recommended should be used for maintenance of existing channel between the mouth and Clear Run.

The commerce for 1900, 58,087 tons, is a gain of 9,554 tons over the previous year.

The improvement has been in local charge of Assistant Engineer Charles Humphreys.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1900, balance unexpended	\$1, 139. 62
June 30, 1901, amount expended during fiscal year	830. 35
July 1, 1901, balance unexpended	309. 27
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	3, 000. 00

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886.....	\$3, 000	\$3, 000	June 3, 1896.....	\$1, 000	\$16, 000
July 13, 1892.....	10, 000	13, 000	March 3, 1899.....	2, 000	18, 000
August 17, 1894.....	2, 000	15, 000			

Other receipts: March 14, 1897, sale to Cape Fear River, \$243.34.

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	190	Turpentine, spirits	843
Cotton seed	60	Tar	1, 701
Cotton-seed meal	10	Wood	7, 000
Grains	50	Timber	22, 300
Hay	38	Lumber	55
Potatoes	20	Shingles	1, 500
Cattle	110	General merchandise	17, 920
Horses	25	Machinery	220
Hogs	32	Rice	6
Poultry	41	Peanuts	3
Fertilizers	789	Dog tongue.....	25
Eggs	17		
Rosin	4, 964	Total	58, 087
Turpentine, crude	168		

Number of passengers, 697.

Increase since last year, 9,554 tons. Transportation lines established during the year, 1. All of the above passed over 12 miles of Cape Fear River, North Carolina, above Wilmington, but is not included in the report for that river.

Freight transported.

Calendar year ending Dec. 31—	Tons.	Calendar year ending Dec. 31—	Tons.
1885	48,650	1895	63,262
1890	61,311	1896	69,033½
1891	79,429	1897	51,144
1892	56,051	1898	38,139
1893	45,003	1899	48,533
1894	41,130½		

Statement of vessels navigating Black River, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Steamers	4	180.72	<i>Feet.</i> 3 to 3.5
Steam tugs	5	105.86	3.5 to 4.5
Flats	a 38	2,750	1.5 to 4

a About.

L 12.

IMPROVEMENT OF NORTHEAST (CAPE FEAR) RIVER, NORTH CAROLINA.

For previous history see annual report for 1900, pages 273 and 1815.

Work during the year has consisted of maintenance by snagging, at a cost of \$1,051.45, and there have been removed from the channel 528 stumps and 1,631 snags, and from the banks 704 trees. The work was suspended in March, and the small balance available reserved for care of plant.

The governing low-water depth is 6 feet to Bannerman's bridge, above which point navigation is practicable only during freshet stages.

The available balance will be used for care of plant, and the additional appropriation recommended should be used for maintenance of existing channel between Wilmington and Hallsville.

The commerce during the year amounted to 56,748 tons, a gain of 8,479 tons over the previous year.

The improvement has been in local charge of Assistant Engineer Charles Humphreys.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1900, balance unexpended	\$1,056.13
June 30, 1901, amount expended during fiscal year.....	1,051.45
July 1, 1901, balance unexpended.....	4.68
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	3,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

September 19, 1890, for North East (Cape Fear) River, North Carolina...	\$5,000.00
July 13, 1892, for North East (Cape Fear) River, North Carolina.....	5,000.00
August 18, 1894, for North East (Cape Fear) River, North Carolina.....	5,000.00
March 3, 1899, for North East River, North Carolina.....	2,000.00
Other receipts: March 4, 1897, sales to Cape Fear River.....	243.33

Total 17,243.33

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	273	Rosin.....	1,704
Cotton-seed meal.....	30	Turpentine, crude.....	205
Cotton-seed oil.....	2	Turpentine, spirits.....	290
Cotton seed.....	309	Wood.....	7,700
Rice.....	20	Timber.....	24,174
Grains.....	154	Lumber.....	186
Hay.....	41	Shingles.....	900
Potatoes.....	66	Tar.....	1,044
Peanuts.....	30	Brick.....	7,500
Fruits and vegetables.....	3	Fertilizers.....	7,888
Cattle.....	25	General merchandise.....	4,000
Hogs.....	31	Lime.....	115
Poultry.....	40		
Eggs.....	16	Total.....	56,748
Fish.....	2		

Increase since last year, 8,479 tons.

Transportation lines established during the year, none.

Number of passengers, 350.

Six thousand nine hundred and ninety-seven tons of the above fertilizers passed over only 2 miles of the lower end of the river.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890.....	40,596	1895.....	39,721
1891.....	30,295	1896.....	85,163½
1892.....	37,429	1897.....	63,398
1893.....	40,388	1898.....	59,422
1894.....	41,096	1899.....	48,269

Statement of vessels navigating North East River, North Carolina, during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Steamers.....	2	92.06	<i>Feet.</i> 3 to 3.5
Steam tugs.....	9	178.53	2.5 to 7.5
Flats.....	a 44	3,300	1.5 to 4

a About.

L 13.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA, ABOVE WILMINGTON.

For previous history see annual report for 1900, pages 274 and 1816.

Work during the year has consisted of maintenance by snagging at a cost of \$1,204.78, and there have been removed from the channel 345 stumps, 1,174 logs, 91 trees, 1,436 snags, and 1 wreck. Work was suspended in March and the small balance available reserved for care of plant.

The condition of the river is about the same as last year, the governing low-water depths being 4 feet to Kellys Cove, $2\frac{1}{2}$ feet to Elizabethtown, and 2 feet to Fayetteville.

A preliminary examination was made for the purpose of determining as to the advisability of making a survey for proposed 4 feet, 6 feet, and 8 feet navigation throughout the year between Wilmington and Fayetteville. Later a survey and estimates were made for the same purpose; report printed in House Doc. No. 180, Fifty-sixth Congress, second session.

The small available balance will be used for care of plant stored at depot. The additional appropriation recommended should be used for maintenance of existing channel. No further appropriation for improvement is recommended until the adoption of a project for slack-water navigation.

The commerce for the year amounted to 129,622 tons, a gain of 14,745 tons since the previous year, and the largest on record.

This improvement has been in local charge of Assistant Engineer Charles Humphreys.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1900, balance unexpended	\$3,117.98
June 30, 1901, amount expended during fiscal year	3,037.93
July 1, 1901, balance unexpended	80.05
July 1, 1901, outstanding liabilities	21.36
July 1, 1901, balance available	58.69
{ Amount (estimated) required for completion of existing project	132,750.00
{ Amount that can be profitably expended in fiscal year ending	
{ June 30, 1903, in addition to the balance unexpended July	
{ 1, 1901:	
{ For works of improvement..... ⁽¹⁾	
{ For maintenance of improvement	
{ \$8,000.00	
{	
{ 8,000.00	
{ Submitted in compliance with requirements of sundry civil act of June	
{ 4, 1897, and of section 7 of the river and harbor act of 1899.	

¹ Nothing recommended for improvement until adoption of project for slack-water navigation.

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	\$30,000.00	\$30,000.00	August 18, 1894	\$14,000.00	\$132,250.00
August 2, 1882	30,000.00	60,000.00	June 3, 1896	5,000.00	137,250.00
July 5, 1884	5,000.00	65,000.00	March 3, 1899	5,000.00	142,250.00
August 5, 1886	11,250.00	76,250.00	Other receipts: Sales to		
August 11, 1888	12,000.00	88,250.00	other appropriations		
September 19, 1890	15,000.00	103,250.00	during 1897		414.33
July 13, 1892	15,000.00	118,250.00			

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	408	Turpentine, spirits	659
Cotton seed	25	Tar	1,991
Cotton-seed meal	175	Wood	10,000
Cotton-seed oil	39	Timber	43,294
Grains	81	Lumber	250
Rice	200	Shingles	938
Straw	250	Fertilizer	33,552
Hay	13	Machinery	60
Potatoes	30	General merchandise	30,140
Cattle	119	Coal	4
Horses	25	Brick	2,700
Hogs	51	Peanuts	5
Poultry	128	Fish	1
Eggs	53		
Rosin	4,195	Total	129,622
Turpentine, crude	236		

Number of passengers, 1,955.

Increase since last year, 14,745 tons. Transportation lines established during the year, none. Twenty-nine thousand five hundred and fifty-five tons of the above fertilizers passed over only 4 miles of the lower end of this river. All of Black River commerce passes over 12 miles of this river, but is not included in the above.

Statement of vessels navigating Cape Fear River, North Carolina, above Wilmington, during the year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Steamers	6	486.60	<i>Fect.</i> 3.0 to 4
Steam tugs	6	114.42	3.5 to 7

Freight transported.

Calendar year ending Dec. 31—	Tons.	Calendar year ending Dec. 31—	Tons.
1880	50,000	1895	103,727
1890	129,000	1896	99,357½
1891	88,638	1897	91,841
1892	72,810	1898	99,943
1893	92,757	1899	114,877
1894	85,497		

L 14.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA, AT AND BELOW WILMINGTON.

For previous history, see annual report for 1900, pages 274 and 1818.

During the year and in continuation of the project of October 6, 1900, to obtain depth of 20 feet and width of 270 feet at Wilmington, and from Wilmington to the ocean, dredging has been carried on, by United States plant and hired labor, in river channels and on ocean bar, as follows:

Between July 1, 1900, and March 9, 1901, the clam-shell dredge *Ajax*, in pursuance of project, removed from Brunswick River Shoal 277,088 cubic yards of mud and sand, 157 stumps, and 41 logs, and from Logs and Big Island Shoal 35,244 cubic yards of mud and sand, 77 stumps, and 1 log. To maintain channels already dredged the *Ajax* removed from Lilliput Shoal 1,068 cubic yards of mud, and from Old Brunswick Cove Shoal 64,795 cubic yards of mud.

The cost of *Ajax* dredging for the year has been, for operating alone, \$17,062.29, for 378,195 cubic yards of mud and sand, 234 stumps, and 42 logs. Since its purchase, in December, 1896, this dredge has taken out 2,378,498 cubic yards of mud and sand, 702 stumps, and 385 logs, at a cost, for operating alone, of \$86,098.40, an average of 3.62 cents per cubic yard for operating.

The purchase, construction, and maintenance account for the *Ajax* and its attendant plant to June 30, 1901, aggregates \$98,303.52, an average of 4.13 cents per cubic yard for plant. The condition of the plant is excellent, with the exception of the hull of the dredge, which must be rebuilt when more funds become available. The tug *Easton* is unserviceable and no longer included in the available plant. The cost of dredging with this plant may be summarized as follows, not including logs and stumps:

From purchase in December, 1896, to June 30, 1901:

For 2,378,498 cubic yards—	Cents.
For plant, per cubic yard	4. 13
For operating, per cubic yard.....	3. 62
Total, per cubic yard	<u>7. 75</u>

During fiscal year 1900-1901:

For 378,195 cubic yards—	
For plant, per cubic yard.....	4. 13
For operating, per cubic yard.....	4. 51
Total, per cubic yard.....	<u>8. 64</u>

The increased cost of dredging this year is due to the many stumps encountered, and to the fact of the plant being laid up March 9 for want of funds, causing an unusually large charge per cubic yard for care of plant.

The suction dredge *Cape Fear* returned from Florida February 4, and worked about four and three-quarters months, restoring the bar depth to 21.7 feet, the 20-foot channel being 350 feet wide, removing from the ocean bar 140,400 cubic yards, and from Snows Marsh Channel 53,254 cubic yards, a total of 193,654 cubic yards, at a cost for operating alone of \$7,797.42, or 4.03 cents per cubic yard. Since

her completion, in June, 1895, this boat has dredged 1,840,423 cubic yards, at a cost for operating alone of \$73,541.84, or 4.00 cents per cubic yard. The sea dump has been moved 2 miles farther west, increasing cost of operating.

The purchase, construction, and maintenance account for this dredge amounts to \$89,867.47, an average for the 1,840,423 cubic yards dredged since her delivery of 4.88 cents per cubic yard.

The above totals differ from those in previous reports (1896 to 1900, inclusive), a remeasurement of the bins of suction dredge *Cape Fear* having indicated an excess error of about 15 per cent in former calculations.

Summary of cost of dredging by suction dredge Cape Fear.

From date of delivery, June, 1895, to June 30, 1901:

For 1,840,423 cubic yards—	Cents.
For plant, per cubic yard	4.88
For operating, per cubic yard	4.00
Total, per cubic yard	8.88

For the fiscal year 1900-1901:

For 193,654 cubic yards—	
For plant, per cubic yard	4.88
For operating, per cubic yard	4.03
Total, per cubic yard	8.91

This dredge was loaned to the St. Johns River (Florida) improvement from April 5, 1900, to February 4, 1901, for which the Cape Fear River improvement received \$7,593.57, of which \$162.97 was credited to operating account and \$7,430.60 to purchase, construction, and maintenance account.

Including the work of both dredges, a total of 571,849 cubic yards was dredged during the year, which included dredging for maintenance at Brunswick River, Lilliput, and Old Brunswick Cove shoals and on the ocean bar, at a cost of \$16,603.04. On account of the small balance available, the dredge *Ajax* and its attendant plant were laid up March 9, 1901, and for the same reason the suction dredge will be laid up as soon as the bar channel is in such shape as to give reasonable assurance of project depth holding during the cotton-shipping season, when it is most needed. The balance of funds on hand will be held in reserve for any emergency work necessary on the river until the passage of a new river and harbor bill. The next appropriation should include \$128,000 for maintenance, as shown in summary in chief of engineer's report, \$200,000 for continuation of work under project, and \$50,000 for shore protection at Baldhead Point. This last item is of special importance, as the channel is steadily cutting into the shore and the channel itself moving bodily to the eastward. The old Woodbury jetty is now nearly in the center of the channel, with 30 to 35 feet depth all around it, and unless the erosion of Baldhead Point is checked and the channel movement stopped it will be necessary in the near future to remove the remains of the jetty from the channel. A continuation of the channel movement to the east threatens to seriously affect the present bar channel and possibly entail the adoption of a new line across the bar.

Considerable surveying has been done during the year, with a view of having available all necessary data for making recommendation as to project when new funds become available.

The Swash Defense and New Inlet dams are in practically the same condition as last year, no funds being available for their proper repair, which will require several thousand tons of stone.

The tug *Richard Caswell* was completed by the Columbian Iron Works and Dry Dock Company and delivered October 16, 1900. This tug is 84 feet 10 inches long, 18½ feet beam, 7½ feet mean draft; hull and house of steel, engine fore and aft compound, 14 and 28 by 22 inch stroke. The contract price of this tug, delivered at Wilmington, was \$26,500, and about \$1,500 was spent for inspection expenses, equipment, etc. She is a powerful and able boat and in every way satisfactory.

PRESENT CONDITION OF THE WORK.

Except for deterioration, the condition of the river channel is the same as last year, with the following exceptions: At Logs and Big Island Shoal the 20-foot channel has been increased in width to 148 feet throughout; at Brunswick River Shoal the 20-foot channel has been widened to 185 feet for 7,600 feet of its length and to 222 feet for the remaining 1,000 feet; at Old Brunswick Cove Shoal the least depth was increased by redredging to 20 feet.

Money statement.

July 1, 1900, balance unexpended	\$96, 279. 97
March 22, 1901, received for rent of dredge <i>Cape Fear</i>	7, 593. 57
	103, 873. 54
June 30, 1901, amount expended during fiscal year	71, 796. 07
July 1, 1901, balance unexpended	32, 077. 47
July 1, 1901, outstanding liabilities	2, 221. 74
July 1, 1901, balance available	29, 855. 73
{ Amount (estimated) required for completion of existing project	885, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$250, 000. 00
For maintenance of improvement	128, 000. 00
	378, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 2, 1829, to July 22, 1854		a \$363, 228. 92	August 2, 1882	\$225, 000	\$1, 502, 500. 00
July 11, 1870	\$100, 000	100, 000. 00	July 5, 1884	200, 000	1, 702, 500. 00
March 3, 1871	75, 000	175, 000. 00	August 5, 1886	157, 500	1, 860, 000. 00
June 10, 1872	100, 000	275, 000. 00	August 11, 1888	245, 000	2, 105, 000. 00
March 3, 1873	100, 000	375, 000. 00	September 19, 1890	170, 000	2, 275, 000. 00
June 23, 1874	150, 000	525, 000. 00	July 13, 1892	200, 000	2, 475, 000. 00
March 3, 1875	150, 000	675, 000. 00	August 18, 1894	200, 000	2, 675, 000. 00
August 14, 1876	132, 500	807, 500. 00	June 3, 1896	195, 000	2, 870, 000. 00
June 18, 1878	160, 000	967, 500. 00	March 3, 1899	150, 000	3, 020, 000. 00
March 3, 1879	100, 000	1, 067, 500. 00	Other receipts: Sales and rents to other appropriations.	1, 024. 56 3, 718. 40 7, 593. 57	12, 336. 53
June 14, 1880	70, 000	1, 137, 500. 00			
March 3, 1881	140, 000	1, 277, 500. 00			

a Balance of \$3,728.07 turned over to surplus fund.

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER, 31, 1900.

Exports, foreign and coastwise.

[Furnished by Col. J. L. Cantwell, secretary Wilmington Produce Exchange.]

	Tons.
Cotton.....	70, 797
Lumber.....	77, 646
Shingles.....	1, 733
Rosin.....	26, 245
Tar.....	6, 871
Turpentine, spirits.....	4, 481
Turpentine, crude.....	683
Pitch.....	320
Cotton and yarn goods.....	831
Miscellaneous (estimated).....	65, 000
Total.....	254, 607

Exports, internal.

[Furnished by steamboat, flat, and raft men.]

Miscellaneous.....	96, 796
Total of exports (foreign, coastwise, and internal).....	361, 403

Imports, foreign and coastwise.

[Furnished by importers and manufacturers.]

	Tons.
Fertilizers and fertilizer material.....	55, 436
Coal.....	13, 985
Salt.....	5, 799
Oil.....	12, 496
Cement.....	2, 630
Grains (corn and rice).....	1, 700
Miscellaneous (naval stores, cotton, and general merchandise).....	100, 000
Total.....	191, 146

Imports, internal.

[Furnished by steamboat, flat, and raft men.]

	Tons.
Cotton.....	896
Tar.....	5, 016
Turpentine, spirits.....	1, 916
Turpentine, crude.....	851
Rosin.....	11, 663
Lumber and timber.....	91, 268
Shingles.....	3, 369
Wood.....	27, 700
Miscellaneous.....	14, 128
Total.....	156, 807
Total of (imports foreign, coastwise, and internal).....	347, 953

Summary.

Exports:	Tons.
Foreign and coastwise	254,607
Internal	96,796
Imports:	
Foreign and coastwise	191,146
Internal	156,807
Total	699,356

Increase since last year, 77,504 tons.

Transportation lines established during the year, 2.

Foreign commerce for the year 1900.

[Furnished by the collector of customs of the port of Wilmington, N. C.]

Class of goods.	Quantity.	Value.	
		Exports.	Imports.
Cotton	bales. 257,774	\$12,974,027	.....
Rosin	barrels. 144,245	209,187	.....
Tar	do. 18,924	30,290	.....
Pitch	do. 1,005	1,801	.....
Spirits of turpentine	gallons. 77,220	29,981	.....
Lumber	M ft. 9,765	144,815	.....
Shingles	M. 2,429	12,845	.....
Miscellaneous	tons.	38,896	.....
Kainit	do. 9,499	.....	\$66,540
Salt	do. 1,300	.....	3,773
Potash (muriat and sulphate of)	do. 794	.....	28,052
Pyrites	do. 5,201	.....	7,725
Molasses	gallons. 5,734	.....	1,158
Manure salt	tons. 2,434	.....	25,396
Miscellaneous	do. ....	.....	5,958
Total .....	.....	13,441,842	138,602

Freight transported, calendar year ending December 31—

	Tons.		Tons.
1869	220,000	1894	437,623
1889	325,512	1895	618,054
1890	346,557	1896	673,208
1891	344,743	1897	595,426
1892	341,468	1898	627,899
1893	392,965	1899	621,852

Cotton steamers loaded at the port of Wilmington, N. C., during the calendar year ending December 31, 1900.

[Furnished by Messrs. Alex. Sprunt & Son and Mr. J. H. Sloan.]

Name of steamer.	Registered tonnage.	Draft loaded.	Bales.
Aquila	1,404	17.5	8,052
Chatburn	1,224	16	6,725
Skuld	937	16	5,200
Bendo	2,281	19.5	12,077
Aquila	1,404	17.5	7,839
Yearby	1,664	15.5	9,800
Skuld	937	16	5,200
Arnold Loyken	1,095	17	5,300
Aislaby	1,798	18.5	9,581
Falk	1,443	18	6,850
Louise	2,143	18.5	11,750
Alnwich	1,956	19	10,090
Wingrove	1,818	17.5	9,358

Cotton steamers loaded at the port of Wilmington, N. C., etc.—Continued.

Name of steamer.	Registered tonnage.	Draft loaded.	Bales.
Oaklands.....	1,252	17	6,074
Bellerby.....	1,979	17.5	10,000
Vellecha.....	1,648	18.5	8,051
Kassaba.....	2,497	19	13,718
Doleby.....	2,353	18	12,364
Buckminster.....	1,297	17	6,714
Polana.....	1,898	19	9,630
Enstrv.....	1,924	18.5	10,530
Wandby.....	2,580	19	14,596
Dora.....	1,105	16	5,655
Oaklands.....	1,252	16.5	6,300
Kingswood.....	1,209	14.5	6,739
Aquila.....	1,404	17.5	7,846
Teresa.....	2,518	16.5	12,765
Oscar I.....	1,999	18	9,250
Dowgate.....	1,869	16.5	9,450
Total.....	48,888		257,504

Statement of vessels of 100 tons and over at the port of Wilmington N. C., for the calendar year ending December 31, 1900.

[Furnished by Capt. Edgar Williams, harbor master.]

Class of vessels.	American.		Foreign.		Total.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Steamers.....	101	125,949	36	61,177	137	187,126
Barks.....	4	2,729	32	18,347	36	21,076
Brigs.....	6	1,967	2	514	8	2,481
Barges.....	29	29,156			29	29,156
Schooners.....	82	25,629	15	2,728	97	28,357
Total.....	222	185,430	85	82,766	307	268,196

The above does not include vessels which took cargoes to Southport; vessels coming to Southport in distress, for supplies, or for a harbor, the total estimated tonnage of which is 15,000, or vessels and barges taking cargoes to Fort Caswell, the total estimated tonnage of which is 40,000.

Vessels owned by the United States Government are not included. No record is made of steamboats plying on the rivers above Wilmington, or of small vessels and steam tugs of less than 100 tons.

Statement of vessels plying on the Cape Fear River, North Carolina, at and below Wilmington, during the calendar year ending December 31, 1900.

[This statement is in addition to that furnished by Capt. Edgar Williams.]

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
Steamers.....	17	7,055	<i>Feet.</i> 2 to 17
Steam tugs.....	13	297	2 to 10

L 15.

IMPROVEMENT OF TOWN CREEK, BRUNSWICK COUNTY, NORTH CAROLINA.

For previous history see annual report for 1900, pages 275 and 1827.

At the end of the last fiscal year the stream had been cleared to Three Creeks, a short distance above Russell's landing, and the project for a channel 5 feet deep and 40 feet wide to Russell's landing had

been completed. During the past year snagging was continued to Rock's landing and the entire project completed. There were removed from the channel 347 stumps, 14 logs, 44 trees, 1,297 snags, and 1 old flat, and from the banks 2,095 trees were trimmed and pulled back.

The commerce reported for the year amounts to 9,146 tons, while for the previous year it was reported as 61,859 tons. An effort to determine the cause of this apparent great falling off has been unsuccessful, but it is believed that the amounts of wood, timber, and lumber during 1899 were considerably overestimated, and it is probable that some items for the year 1900 have not been obtained, on account of the difficulty of checking up the cargoes of small sailboats and flats, which are not consigned to any special agents, but are brought to Wilmington and sold at the wharves to the first comer.

The small available balance will be used for care of plant stored at depot. The additional appropriation recommended should be spent for maintenance of existing channel up to Russell's landing.

This improvement has been in local charge of Assistant Engineer Charles Humphreys.

This creek is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1900, balance unexpended	\$1, 220. 14
June 30, 1901, amount expended during fiscal year.....	1, 122. 59
July 1, 1901, balance unexpended	97. 55
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	2, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Abstract of appropriations.

March 3, 1881.....	\$1, 000
March 3, 1899.....	8, 500
Total	9, 500

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1900.

Class of goods.	Quantity.	Class of goods.	Quantity.
	<i>Tons.</i>		<i>Tons.</i>
Cotton	25	Timber	1,500
Cotton seed	25	Lumber	300
Cotton-seed meal	20	Shingles	31
Rice	400	Fertilizers	160
Rice straw	750	Machinery	5
Hay	25	General merchandise	1,000
Potatoes	150	Fish	1
Cattle	3	Watermelons	25
Hogs	9	Peanuts	60
Poultry	7	Grains	50
Eggs	3	Tar	280
Rosin	800	Vegetables	1
Turpentine, crude	242	Brick	150
Turpentine, spirits	124		
Wood	3,000	Total	9,146

Decrease since last year, 52,713 tons.

Transportation lines established during the year, none.

Number of passengers, 250.

Statement of vessels navigating Town Creek, Brunswick County, N. C., during the calendar year ending December 31, 1900.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			<i>Foot.</i>
Steamers	1	25	3
Steam tugs	4	51	3.8 to 4.3
Plats	10	250	3
Sharpies	1	11	4

L 16.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

An allotment was made from this appropriation in May, 1901, for an examination of the wreck of the schooner *Hooper*; report was submitted, of which the following is an extract:

The wreck was found to be located in longitude 76° 2' 30" and in latitude 35° 20' 30", and is sunk and stranded on a shoal about 4 miles southwest of the entrance to Wyesocking Bay and about 5 miles northwest of the usual track of vessels navigating Pamlico Sound. The wreck has been stripped of masts and rigging, and the deck-house and deck have been torn away by gales and washed ashore. The hull is barely visible at short range above the water surface, and is apparently held in position by its load of oysters, and also by accumulating sand. It is hardly likely to be dislodged by gales, and the woodwork not covered by drifting sand will probably be eaten away by worms in the course of a year or two.

At its distance from the usual course of vessels it is not likely to become a serious menace to navigation, and it is at present located on a shoal shown on Coast Survey Chart 143 with a least depth of 4½ feet. If its removal is deemed desirable or necessary it can be effected at an estimated cost of \$200.

L 17.

EXAMINATION AND SURVEY OF WATERWAY FROM SOUTH MILLS, NORTH CAROLINA, TO AND INCLUDING OCRACOKE AND BEAUFORT INLETS.

[Printed in House Doc. No. 202, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 11, 1900.

SIR: The emergency river and harbor act of June 6, 1900, makes provision for a preliminary examination and survey to be made at the following locality, viz:

Pasquotank River [North Carolina]: With the view of obtaining a navigable depth of sixteen feet at mean low water from South Mills, on the Pasquotank River,

thence down the Pasquotank River, through Albemarle Sound, Croatan Sound, Pamlico Sound, and Core Sound, to Beaufort Inlet, including also cost of procuring a navigable depth of eighteen feet through Beaufort Inlet and eighteen feet through Ocracoke Inlet, respectively.

The duty of making the examination and survey of that part of the prescribed route embraced between South Mills and the 16-foot curve in Albemarle Sound was assigned to Maj. James B. Quinn, Corps of Engineers, copies of whose reports, dated respectively August 10 and November 17, 1900, upon the subject are submitted herewith. The duty of making the examination and survey of that portion of the route south of the 16-foot depth in Albemarle Sound was assigned to Capt. E. W. Van C. Lucas, Corps of Engineers, and copies of his reports, dated respectively August 8 and November 22, 1900, with map, upon the subject are also submitted herewith.

From South Mills to the 16-foot curve in Albemarle Sound (about 37.5 miles).—South Mills is located at the southern terminus of the Dismal Swamp Canal, which is controlled and operated by the Lake Drummond Canal and Water Company, and to reach the Pasquotank River from that point it is necessary to pass through an artificial waterway known as Turners Cut, 4.2 miles long. Throughout the route from South Mills to Albemarle Sound there is a navigable depth of 8 feet, and Major Quinn states that the body of the Dismal Swamp Canal throughout has been dredged by the company "to give the required depth of 8 feet." The cost of obtaining a channel from South Mills to Albemarle Sound of 16 feet in depth, with widths varying according to locality from 300 feet to 80 feet, is estimated by Major Quinn at \$1,935,893.62, and it is his opinion, in view of the possible extension of the improvement southward, that the work proposed in his report is worthy of being undertaken by the General Government.

From the 16-foot curve in Albemarle Sound to and including Ocracoke and Beaufort inlets.—The distance from Albemarle Sound to the ocean at Beaufort Inlet by this route is 136 miles. The outlet at Ocracoke Inlet is 10 miles long. Captain Lucas is of opinion that it is not now necessary to open both Ocracoke and Beaufort inlets, as a single route will probably be sufficient for all present needs. The alternative plans of improvement presented by him contemplate a channel width throughout of 300 feet and a depth of 16 feet, except through Ocracoke and Beaufort inlets, where the depth proposed is 18 feet, the cost of the work being estimated as follows:

Improvement of route via Ocracoke Inlet (omitting Beaufort Inlet), including cost of two suction dredges, designed for maintenance.....	\$1, 611, 500
Improvement of route via Beaufort Inlet (omitting Ocracoke Inlet), including cost of two suction dredges, designed for maintenance.....	3, 597, 000
Annual cost of operation of two dredges, about.....	50, 000

Captain Lucas discusses the relative merits of the routes, and expresses the opinion that the improvement proposed is a worthy one, but that the Government should not commit itself to so large an expenditure as would be required for improvement of the entire route mentioned in the act without first considering the question of ownership of one or both of the private canals at the northern end, viz, the Dismal Swamp Canal and the Albemarle and Chesapeake Canal, the latter being part of a route distinct from that prescribed in the above-quoted item of the act. Captain Lucas calls attention also to the possible advantage of utilizing the Clubfoot and Harlowe Canal route instead of the Core Sound section as a connecting link between Pam-

lico Sound and Beaufort Harbor, stating, however, that an absolute comparison of the two routes could be made only after a survey shall have been made of the Clubfoot and Harlowe route, a section not included in the route prescribed by the act. The necessary investigation in this connection could be made in a few weeks' time.

Major Quinn and Captain Lucas both refer to the advantage of the proposed improvements to the Government in case of war.

Major Quinn's report of survey was forwarded to this office by the Division Engineer, Col. Peter C. Hains, Corps of Engineers, by indorsement of November 21, and Captain Lucas's survey report was forwarded by Colonel Hains by indorsement of December 1; these indorsements accompany the papers now submitted, and the views expressed by the division engineer deserve careful consideration.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF WATERWAY FROM SOUTH MILLS, N. C.,
TO ALBEMARLE SOUND, VIA PASQUOTANK RIVER, WITH THE VIEW OF
OBTAINING A NAVIGABLE DEPTH OF 16 FEET AT MEAN LOW WATER.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., August 10, 1900.

GENERAL: In accordance with the instructions given in the letter from your office, dated July 3, 1900, relative to preliminary examinations authorized by the act of June 6, 1900, and assigned to me for investigation, I have the honor to submit the following report as to the "Pasquotank River from South Mills to the 16-foot curve in Albemarle Sound, North Carolina," with a view to the improvement of that portion of the inland water route described in the act referred to above, quoted below:

Pasquotank River: With the view of obtaining a navigable depth of sixteen feet at mean low water from South Mills, on the Pasquotank River, thence down the Pasquotank River, through Albemarle Sound, Croatan Sound, Pamlico Sound, and Core Sound, to Beaufort Inlet, including also cost of procuring a navigable depth of eighteen feet through Beaufort Inlet and eighteen feet through Ocracoke Inlet, respectively.

The distance from South Mills to the 16-foot curve in Albemarle Sound is about $37\frac{1}{2}$ miles. From Elizabeth City, N. C., to the 16-foot contour in the sound, 20 miles distant, the present minimum channel depth, is 11 feet, while above the town to South Mills a channel 10 feet in depth exists, except at Ship Yard Bar, where there is now about 9 feet of water. There is no lunar tide; and whatever changes occur in the normal water level are due to wind pressure, which generally causes a fall or rise in stormy weather of about 0.5 of a foot according to the direction of the wind.

South Mills is located at the southern terminus of the Dismal Swamp Canal, which is now controlled and operated by the Lake Drummond Canal and Water Company, and to reach the Pasquotank River from that point it is necessary to pass through an artificial waterway known

as Turners Cut, 4.2 miles long, excavated some time ago to shorten the natural circuitous route to the river via the Moccasin Track.

The Pasquotank River, in its upper reaches, is a sinuous and narrow stream, while for 5 miles above Elizabeth City it has a width of 500 feet. When the work now contemplated in the river has been finished the upper portion will be unobstructed by the abrupt bends, and the bar in the vicinity of Ship Yard Landing will have a channel 10 feet deep, which, together with the improvement of Turners Cut, will give a good navigable 10-foot channel to South Mills.

The object of providing a 16-foot waterway is to develop the shipment of coal and other products between the North and South in barges, as a cheaper means of transportation than is now in vogue. It is claimed that the dangers off Hatteras have prevented the establishment of this enterprise, and that if inland water communication, as outlined, could be attained, shippers would be able to forward their freight at about one-half the prevailing rates.

The transportation of freight in barges is well known to be far cheaper than by sail or steam vessels, and the tonnage now handled in this manner between here and Northern ports is quite extensive, and for which a considerable outlay has been made.

It seems to me that a large percentage of the Southern coastwise trade would use such a route if it were established. It would also be of some benefit to the United States in case it should be found desirable during hostilities to dispatch light-draft gunboats, torpedo boats, and torpedo-boat destroyers from the North to the Southern ports and vice versa, thus avoiding any delay which might be occasioned by storms off Hatteras or running the risk of encountering superior ships of the enemy along the stretch of the Southern coast which they would be compelled to navigate in the absence of inland navigation sufficient to accommodate them.

The commerce to be expected by the improvement would be of a general character and would probably include vessels sailing to and from all ports of this country south of Norfolk. Some shipments of coal are now made in barges through the present channel of the route from this city to Wilmington and Newbern, N. C. The present commerce is shown by the statements hereto appended, which indicate the traffic of the two inland routes between Norfolk and the North Carolina sounds.

I believe the Pasquotank River from South Mills to the 16-foot channel in Albemarle Sound worthy of improvement to the end that a depth of 16 feet at mean low water be provided. Such a survey as will be required to enable me to draw up a project for the improvement and to estimate the cost of same will amount to about \$2,500; and as the improvement of a portion of Croatan Sound, which connects Albemarle and Pamlico sounds, North Carolina, is included in the project for which appropriations have been made under the title "improving waterway from Norfolk, Va., to the sounds of North Carolina," the amount could be provided from the available funds for that work.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 13, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

In my opinion the opening of an inland waterway between the Northern and Southern States along the coast is highly desirable, both for commercial and military reasons. The entire waterway, however, should be under the control of the General Government. This would necessitate the purchase by the United States of the Dismal Swamp Canal, if the route herein referred to is adhered to.

I recommend that the survey be made.

PETER C. HAINS,
*Colonel, Corps of Engineers,
 Division Engineer Southeast Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
 U. S. ARMY,
August 17, 1900.

Respectfully submitted to the Secretary of War.

Section 2 of the emergency river and harbor act of June 6, 1900, authorized the Secretary of War to cause preliminary examinations and surveys to be made at certain specified localities, among which is the following:

Pasquotank River [North Carolina]: With the view of obtaining a navigable depth of 16 feet at mean low water from South Mills, on the Pasquotank River, thence down the Pasquotank River, through Albemarle Sound, Croatan Sound, Pamlico Sound, and Core Sound, to Beaufort Inlet, including also cost of procuring a navigable depth of 18 feet through Beaufort Inlet and 18 feet through Ocracoke Inlet, respectively.

The within report of Major Quinn relates to a preliminary examination of that part of the above-prescribed route embraced between South Mills and the 16-foot curve in Albemarle Sound, the duty of making a preliminary examination of the portion of the route southward of Albemarle Sound having been assigned to the engineer officer in local charge of the Wilmington (N. C.) district, whose report thereon will be duly submitted when received.

Major Quinn is of opinion that the Pasquotank River from South Mills to the 16-foot curve in Albemarle Sound is worthy of improvement by the General Government.

Inviting attention to the views and recommendation of the division engineer in preceding indorsement, I recommend that a survey be made and the cost of improvement be estimated, in accordance with the opinion expressed by Major Quinn.

JOHN M. WILSON.
*Brig. Gen., Chief of Engineers,
 U. S. Army.*

[Third indorsement.]

WAR DEPARTMENT,
August 18, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

1516 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

COMMERCIAL STATISTICS.

Statement of traffic through the Dismal Swamp Canal, Virginia and North Carolina, during the six months ending June 30, 1900 (compiled by the Lake Drummond Canal and Water Company).

Articles.	Amount.	Value.
Lumber.....feet, B. M.	37, 922, 078	\$455, 064
Logs.....cords	558	1, 116
Do.....feet, B. M.	1, 481, 681	14, 820
Piles.....linear feet	374, 226	22, 454
Machinery.....tons	13	2, 600
Corn.....bushels	44, 616	22, 308
Oysters.....do	675	506
Potatoes.....do	1, 669	1, 001
Coal.....tons	1, 749	5, 247
Shells.....bushels	3, 800	152
Phosphate.....tons	3, 128	62, 560
Miscellaneous.....do	16, 377	.....
Empty barrels.....number	2, 025	202
Total valuation.....		588, 030

VESSELS.

Class.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steamers.....	525	8	36
Schooners.....	273	7	41
Barges.....	360	9	211
Lighters.....	12	5	25
Rafts.....	25	.....	(¹)
Revenue cutter Boutwell.....			152
Dredge Hobson and scows.....			.....

¹Average of 68,515 feet lumber, etc.

Statement of traffic through the Albemarle and Chesapeake Canal during the calendar year 1899, compiled by the canal company.

VESSELS.

Class.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steamers.....	2, 481	3 to 9	63
Rigged vessels.....	1, 233	3 to 9	51
Unrigged vessels.....	959	3 to 8	215
Rafts of mill logs, etc.....	278	.....	.....
Total number of vessels.....			4, 952
Total tonnage of vessels.....			422, 578
Estimated number of tons of merchandise carried.....			300, 000
Estimated value of merchandise carried.....			\$2, 500, 000

PRELIMINARY EXAMINATION OF WATERWAY FROM ALBEMARLE SOUND, NORTH CAROLINA, TO BEAUFORT INLET, VIA CROATAN, PAMLICO, AND CORE SOUNDS, WITH THE VIEW OF OBTAINING A NAVIGABLE DEPTH OF 16 FEET AT MEAN LOW WATER, AND OF BEAUFORT AND OCRA-COKE INLETS WITH THE VIEW OF OBTAINING NAVIGABLE DEPTHS OF 18 FEET.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., August 8, 1900.

GENERAL: In compliance with instructions contained in letter from your office, dated July 9, 1900, I have the honor to submit the following report of my preliminary examination of—

Pasquotank River: With the view of obtaining a navigable depth of 16 feet at mean low water from South Mills, on the Pasquotank River, thence down the Pasquotank River, through Albemarle Sound, Croatan Sound, Pamlico Sound, and Core Sound, to Beaufort Inlet, including also cost of procuring a navigable depth of 18 feet through Beaufort Inlet and 18 feet through Ocracoke Inlet, respectively.

The part north of Albemarle Sound was assigned to Maj. J. B. Quinn, Corps of Engineers, for examination, and the part south of Albemarle Sound to me.

The object of this proposed project is to obtain an inland waterway of 16 feet depth between Norfolk and either Ocracoke or Beaufort Inlet, south of Hatteras, principally for the use of seagoing barges passing between South Atlantic ports and points north of Chesapeake Bay. The arguments advanced may be summarized as follows:

1. Barge transportation is the cheapest known method for bulky freights like coal, lumber, etc. Its use has, in a few years, reduced by 30 to 40 per cent the rates on north-bound lumber from North Carolina sounds, and by over 75 per cent the rates on north-bound coal from Chesapeake Bay ports.

2. It can not be successfully used for South Atlantic ports, because of perils and delays incident to rounding Cape Hatteras.

3. The establishment of an inland water route between Norfolk and some inlet south of Hatteras, as Ocracoke or Beaufort, will render possible the use of seagoing barges between South Atlantic and Northern ports, with resulting benefits similar to those following their use north of Chesapeake Bay.

The commercial interests affected are very large. If the bulky commodities from the South Atlantic ports have the option of shipment by barge, the barge rate will determine the railroad rate, whether or not shipped by that route; consequently all such commodities, whether now shipped by water or by railroad, would be affected.

The ports affected include Wilmington, N. C.; Georgetown and Charleston, S. C.; Savannah and Brunswick, Ga.; Fernandina and Jacksonville, Fla., and many minor points; but a determination of quantities and values would involve a personal investigation at the various points named, which is not practicable in the time available for preparation of this report.

A survey for the desired 16-foot inland waterway south of Albemarle Sound should include about 40 miles in Croatan Sound, 2 miles over Bluff Shoal in Pamlico Sound, 10 miles in Core Sound, the inner and outer channels at Ocracoke Inlet, and the bar channel at Beaufort Inlet. The survey should also include the 18-mile waterway via Clubfoot and Harlowe Canal, between Neuse River and Beaufort Harbor, which is

probably the best route between Pamlico Sound and Beaufort Inlet. Several previous reports have been made on similar proposed waterways, and there is a general agreement that the Clubfoot and Harlowe route is preferable to Core Sound. Capt. C. B. Phillips, Corps of Engineers, in his report dated January 15, 1880 (see p. 859, Annual Report of the Chief of Engineers for 1880), states:

If Beaufort Inlet is desired as a passage to the ocean for vessels from the North, the Clubfoot and Harlowe Canal route would be more desirable and much less expensive to establish and maintain than the route via Core Sound—

and this statement apparently voices the opinions of all who have investigated the subject.

Letters from the president of the Lake Drummond Canal and Water Company and from Hudson & Bro., of Norfolk, are herewith appended. Attention is invited to the statements therein concerning reductions in freight rates due to introduction of barges, and also to the statement that the canal company has spent nearly \$1,000,000 in deepening to 10 feet.

They have also spent upward of \$50,000 on United States waterways connecting with their canal in order to facilitate traffic.

A final and positive opinion as to the worthiness of the proposed improvement can hardly be given without an investigation that can not be made soon enough to leave time for the survey and report by November 20, 1900; but in my opinion it is beyond doubt worthy of survey and exhaustive report, which will, I believe, warrant an indorsement of the project.

I therefore recommend that the necessary survey be authorized, the estimated cost of which will be as follows:

Croatan Sound	\$3, 000
Ocracoke Inlet, including Bluff Shoal.....	1, 000
Core Sound	500
Clubfoot and Harlowe route	1, 000
Beaufort Inlet.....	500
Total	6, 000

The entire expense of the survey could be borne by the available balance to the credit of Ocracoke Inlet improvement, amounting to \$15,500, if it can properly be so applied. If not, the various parts of the survey can be paid for from available balances as follows: Ocracoke Inlet and Bluff Shoal, from improvement of Ocracoke Inlet, North Carolina; Clubfoot and Harlowe route, from improvement of waterway between Newbern and Beaufort, N. C., and Beaufort Inlet, from improvement of Beaufort Harbor, North Carolina.

Major Quinn also informs me that the cost of survey in Croatan Sound can probably be paid from the appropriation for improvement of waterway from Norfolk, Va., to the sounds of North Carolina, in which case there will remain as necessary only an allotment of \$500 from the appropriation of June 6, 1900, for the necessary work in Core Sound. The proposed work in Core Sound is at the ends only where channels are subject to tidal influence. In the middle and greater portions changes are slight and slow, and the necessary information for estimates can be obtained from Coast Survey charts.

The advantages incident to the successful introduction of large (14 feet draft) seagoing barges for the business of the South Atlantic ports have been recognized by men interested in water transportation, and I am informed that several independent attempts to introduce

them have been made, but each effort has been abandoned because of delays and perils incident to rounding Cape Hatteras.

An advantage of possibly great importance incident to a 16-foot interior waterway would be the establishment of an interior protected line for small naval vessels, torpedo boats, destroyers, etc. The fresh-water basins of Albemarle Sound and its ports would also be made available for such vessels.

Very respectfully,

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 10, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

This is an important inland waterway, both from a commercial and from a military standpoint. The entire line, however, should be under the control of the United States from end to end. Before saying it is worthy of improvement to the extent suggested (16 feet), a survey should be made to determine the cost of the improvement.

I recommend that a survey be made, if the emergency act of June 6, 1900, permits the use of funds as suggested by the district engineer.

* * * * *

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 16, 1900.

Respectfully returned to Captain Lucas.

It is not believed that, under the wording of the law, a survey of the Clubfoot and Harlowe portion of the route is permissible.

Captain Lucas's opinion is desired whether the proposed improvement of the various waterways covered by his preliminary examination under the act would be of value in itself independently of a corresponding improvement of the Dismal Swamp Canal and the Pasquotank River.

* * * * *

To be returned through the division engineer.
By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE,
Wilmington, N. C., August 18, 1900.

Respectfully returned to the Chief of Engineers.

The survey of Clubfoot and Harlowe route is deemed essential to a proper consideration of the inland waterway south of Pamlico Sound,

all investigators on the subject having preferred it, and my own rather intimate knowledge of the localities, extending over several years since 1892, inclining me to agree with them. This part of the proposed survey can, however, be made independently of the act of June 6, 1900, and, in my opinion, should in any case be made, as recent commercial statistics indicate an increased traffic and furnish probable warrant for a resumption of the work of improvement, which should be preceded by a complete survey.

In my opinion, the independent improvement of the waterways covered by this preliminary examination would be of value, although possibly not to the proposed depth of 16 feet; but I do not feel warranted in expressing a positive opinion on the subject before considering, first, the probable cost, which can only be determined after survey, and, second, the commercial interests involved, which can only be determined after considerable investigation.

Considered separately, however, the proposed surveys of Ocracoke and Beaufort inlets will have a positive value in furnishing data which will be worth far more than the estimated cost when the question of further improvement at these localities arises, which it certainly will. The need of such data was felt in the consideration antecedent to adoption of the Ocracoke Inlet project of July, 1894, which, if then available, would probably have resulted in considerable modification of a project the results of which have been unsatisfactory.

* * * * *

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

[Fourth indorsement.]

FORT BANKS, MASS., *August 21, 1900.*

Respectfully submitted to the Chief of Engineers.

I concur in the opinion of the district engineer that the survey of the Clubfoot and Harlowe route is desirable, and if it can not be done as a part of the survey recommended it is desirable to have it done as a separate work.

I do not think, however, that the independent improvement of the waterways referred to in the act to the depth of 16 feet is justified. Their value rests on the fact that they become links in the chain of inland navigation between the North and the South. The canal is also a link and must be improved, if the chain is to have any value.

Very respectfully,

PETER C. HAINS,
Colonel of Engineers,
Division Engineer Southeast Division.

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 25, 1900.

Respectfully submitted to the Secretary of War.

Section 2 of the emergency river and harbor act of June 6, 1900, authorized the Secretary of War to cause preliminary examinations and surveys to be made at certain specified localities, among which is the following:

Pasquotank River [North Carolina]: With the view of obtaining a navigable depth of 16 feet at mean low water from South Mills, on the Pasquotank River, thence

down the Pasquotank River, through Albemarle Sound, Croatan Sound, Pamlico Sound, and Core Sound, to Beaufort Inlet, including also cost of procuring a navigable depth of 18 feet through Beaufort Inlet and 18 feet through Ocracoke Inlet, respectively.

The duty of making a preliminary examination of that part of the above-prescribed route embraced between South Mills and the 16-foot curve in Albemarle Sound was assigned to Maj. James B. Quinn, Corps of Engineers, who, in reporting upon the subject, expressed the opinion that the Pasquotank River from South Mills to the 16-foot curve in Albemarle Sound is worthy of improvement by the General Government, and on August 18, 1900, the Secretary of War approved the recommendation of the Chief of Engineers that a survey be made and the cost of improvement be estimated, in accordance with the opinion expressed by Major Quinn.

The within report relates to a preliminary examination of that portion of the prescribed route south of Albemarle Sound. The local and division engineers deem it essential that any survey having in view the proposed improvement of this line of inland navigation should include what is known as the Clubfoot and Harlowe route; but, in view of the wording of the act, I am of opinion that a survey of this route is not permissible at the present time under the law.

Inviting attention to the opinions of the division engineer in first and fourth indorsements hereon, I recommend, in view of the importance of the commercial interests involved, that the local officer be directed to make a survey of the waterways south of Albemarle Sound specifically described in the act, from the results of which an opinion may be formed as to the amount of improvement that will be justified by the interests involved.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Sixth indorsement.]

WAR DEPARTMENT,
August 27, 1900.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN C. SCOFIELD,
Chief Clerk.

LETTER OF THE LAKE DRUMMOND CANAL AND WATER COMPANY.

THE LAKE DRUMMOND CANAL AND WATER COMPANY,
OFFICE OF THE PRESIDENT,
Baltimore, July 31, 1900.

MY DEAR SIR: Referring to the survey for a 16-foot channel through Pasquotank River, Albemarle, Croatan, Pamlico, and Core sounds, etc., my reasons for advocating this channel are based mainly on the fact that has been brought out within late years of the great reduction in the cost of freighting products that do not necessarily require quick transportation. A development in this line of business has been mainly along the coast from Norfolk north; from Norfolk south it has only been developed to a small degree through the inland channels that now exist by the way of the two canals connecting Chesapeake Bay and Albemarle Sound.

It is a known fact that before barges were introduced the rate of freight charged on coal from Chesapeake Bay to the northern points along the New England coast was as high as \$3 per ton, this coal being carried by rail and sail vessels. With the advent of barges drawn by tugboats this rate has been reduced to 70 cents per ton.

It is also known that it is only a few years since the rate on lumber from Pamlico and Albemarle sounds to Baltimore and Philadelphia was on the basis of about \$5 per thousand feet. This has been reduced already to as low as \$2.50 per thousand feet. Before the reconstruction of the old Dismal Swamp Canal, that now has a draft of 10 feet of water, barges plying in this district were not able to load deeper than 7 feet. These barges are now loading to 8½ feet, and it is only a matter of a few months before the public will receive the benefit of a still further reduction in rates. When you consider that a tugboat drawing six or eight of these barges carrying between 2,000,000 and 3,000,000 feet of lumber is able to pass the Dismal Swamp Canal at present, as against handling lumber by sail vessels and on small canal boats that were only capable of loading to 6 or 7 feet, you can readily see how great a reduction can be made in the cost of carrying this product. This presents the saving that has already been brought about with a 10-foot draft. Now, if you will add to this 10-foot draft 6 feet you will open up the means of inland navigation in such a manner that products seeking an outlet along the entire coast can avail themselves of it. The barges that traverse the northern part of our coast draw about 14 feet of water, and with present construction of broad beam a barge carrying from 4,000 to 5,000 tons is not the exception. The reason barges of this size can not trade South is on account of the danger of Hatteras, which is so well known that it needs no further comment on my part than to say that it entirely shuts off the transportation of tugboats drawing barges.

The volume of trade passing from Norfolk south is very great. In 1897 the three railroads, namely, the Atlantic Coast Line, the Seaboard Air Line, and Southern Railway carried a total tonnage of over fourteen millions. While a large part of this would be the natural trade belonging to the railroads, certainly a large percentage would seek the cheaper means of transportation if it was offered. In addition to this there are millions of tons of freight moving from the southern ports by sail vessels, on which a large saving could be made if barge traffic was open to these ports, both going north and south; and I see no better way for the Government to expend its money than in fostering and building up this character of enterprise.

To show that this is recognized by private capital, the money that has already been expended in the reconstruction of the old Dismal Swamp Canal by the company I represent, amounting to \$900,000, is a fair evidence of what private capital thinks. In this reconstruction we have not asked the Government for one dollar, and we feel that the enterprise will repay us, and stand ready to increase the depth of our canal to meet the 16-foot channel the Government is contemplating through the lower sounds. Again, the Government would certainly be an interested party in seeing these waterways improved and deepened if for no other reason than to supply itself with a channel that could be utilized in time of war in handling lighter draft war vessels, torpedo boats, and torpedo-boat destroyers without encountering the dangers of the sea or the enemy.

Yours, very truly,

W. B. BROOKS, Jr., *President.*

Capt. E. W. VAN C. LUCAS.

LETTER OF MESSRS. HUDSON & BRO.

HUDSON & BRO., FREIGHT TRANSPORTATION,
Norfolk, Va., August 1, 1900

SIR: In reply to your inquiry, there are about 250 barges trading on the Chesapeake Bay and tributaries. As to the cheapest mode of moving bulky cargoes, tugs and barges are the cheapest. For instance, in 1870 coal freights were about \$5 per ton to Eastern ports; to-day they are carrying it for 75 cents per ton.

Again, as to North Carolina freights: In 1885 they were paying on lumber from North Carolina to Baltimore \$4 per thousand feet, to Philadelphia \$5 per thousand feet, and to New York \$6 per thousand feet, and this lumber trade was practically done by sail vessels. About this date the barges commenced to compete on an extensive scale with sail vessels, and as late as 1888 the rate of freight was \$3.50 per thousand feet from North Carolina to Baltimore, \$5 per thousand feet to Philadelphia, and \$6 per thousand feet to New York. To-day the going rate to Baltimore is \$2.50 per thousand feet, \$3 per thousand feet to Philadelphia, and \$4.25 per thousand feet to New York; so there is no question in our minds that the barges and tugs are the cheapest method and have decided advantage over the sail or steam freighters.

As to who is benefited: Everybody is benefited, especially the laboring classes, as they are largely the consumers. Why? Because lumber has been reduced in cost to the consumer \$2 per thousand feet; coal has been reduced \$4 per ton. Therefore

our idea is that the barge business is yet in its infancy, and if it were not for the well-known and dangerous point known as Cape Hatteras, the barge business would very soon be applied south of Cape Henry with equally good results, and the North and South would be equally benefited.

Yours, very truly,

HUDSON & BRO.

Captain LUCAS,

United States Engineer Office.

SURVEY OF WATERWAY FROM SOUTH MILLS, N. C., TO ALBEMARLE SOUND, VIA PASQUOTANK RIVER, WITH THE VIEW OF OBTAINING A NAVIGABLE DEPTH OF 16 FEET AT MEAN LOW WATER.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., November 17, 1900.

GENERAL: Pursuant to the instructions contained in letter from the office Chief of Engineers, United States Army, August 21, 1900, I have the honor to report as follows upon so much of the survey of waterway from Norfolk, Va., to the sounds of North Carolina as was assigned to me.

My survey begins at the lock of the Dismal Swamp Canal at South Mills and terminates at the 16-foot curve of depth in Albemarle Sound in the vicinity of Wade Point Light, North Carolina. Throughout this route there is at present a navigable depth of 8 feet, and the estimates based upon this survey are for a 16-foot depth of channel, and include nothing for the improvement of the Dismal Swamp Canal or its approaches from Norfolk.

A general map showing the route under consideration is printed with Senate Ex. Doc. No. 73, Forty-sixth Congress, second session. Since this document was printed the United States has made extensive improvements in the approaches to the canal, and is still engaged in the work. The Lake Drummond Canal and Water Company has also materially improved the Dismal Swamp Canal by building new locks at the Deep Creek, Va., and South Mills, N. C., ends, and dredging the body of the canal throughout to give the required depth of 8 feet. The description of the canal as given in the document does not apply at present to its navigable condition.

The portion of the navigable waterway included in this survey is about $37\frac{1}{2}$ miles in length, and is not materially affected by tides, the water-level variations of about 0.9 of a foot being caused by storms. The water is fresh at all times in the Pasquotank River.

The section between Albemarle Sound and Elizabeth City is wide, and varies but little in depth throughout. A narrow channel through this portion would be subject to deterioration possibly by wave action, and it would be impracticable to maintain a revetment. For safe navigation a width of channel of 300 feet is therefore necessary. The material composing the bottom is soft mud, except in the vicinity of Wade Point Light, where it is hard yellow sand and clay. The amount of material to be removed is estimated at—

7,510,871 cubic yards soft mud, at 10 cents.....	\$751,087.10
1,083,477 cubic yards hard sand, at 30 cents.....	325,043.10
	1,076,130.20
Contingencies, 10 per cent	107,613.02
Total.....	1,183,743.22

From Elizabeth City to Turners Cut the river for a part of the distance is wide and obstructed with shoals, and for the remainder of the distance rather narrow and tortuous. Through the wider portion, between Elizabeth City and Ship Yard Bar, a channel 150 feet wide will be required for safe navigation. The material is soft mud, and will have to be removed in scows. The amount of material to be handled is—

887,467 cubic yards, at 12 cents	\$106,496.04
Contingencies, 10 per cent	10,649.60

Total	117,145.64
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From Ship Yard Bar to Possum Quarter Landing, about $1\frac{1}{2}$ miles, a channel 100 feet wide on the bottom will be required. The material is soft mud, and can be most economically delivered on the bank with a hydraulic dredge, except at some few points, where a scoop dredge will have to be used. The estimated amount of material is—

39,186 cubic yards, at 15 cents delivered on bank	\$5,877.90
Contingencies, 10 per cent	587.79

Total	6,465.69
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From Possum Quarter Landing to entrance to Turners Cut the river is narrow and tortuous, and much of the work will be devoted to rectification of the bends. An 80-foot bottom width of channel will be necessary. The shores and points are heavily wooded, and the material is full of roots and stumps. The material is hard sand, containing a lot of logs, roots and stumps, and standing trees, all of which will have to be placed on the bank. For a channel 80 feet wide at the bottom, with side slopes of 1 on 2, it is estimated that 541,233 cubic yards of material, composed of sand, roots, timber, etc., will have to be removed, for which my estimate is as follows:

541,233 cubic yards, at 25 cents	\$135,308.25
Contingencies	13,530.82

Total	148,839.07
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From the entrance to Turners Cut to the lock at South Mills the channel is artificial and will have to be widened and deepened to give a safe channel. The bottom width should be 80 feet and the side slopes 1 on 3 to insure stability. The material is sand, in many places full of roots and stumps, all of which will have to be placed on the bank. The present right of way is too narrow to accommodate the channel and spoil bank, and some land will have to be acquired. A drawbridge crosses the canal a short distance below the lock. This will have to be rebuilt. The estimated cost of this portion of waterway will be:

For dredging 1,724,000 cubic yards, at 25 cents	\$431,000.00
Contingencies, 10 per cent	43,100.00

	474,100.00
For bridge	4,000.00
For 160 acres of land, at \$10 per acre	1,600.00

Total	479,700.00
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SUMMARY.

From Albemarle Sound to Elizabeth City.....	\$1, 183, 743. 22
From Elizabeth City to Ship Yard Bar.....	117, 145. 64
From Ship Yard Bar to Possum Quarter Landing.....	6, 465. 69
From Possum Quarter Landing to Turners Cut.....	148, 839. 07
From Turners Cut to lock at South Mills, N. C.....	479, 700. 00
Total.....	1, 935, 893. 62

It is probable that the possibilities of constructing a navigable waterway so as to provide secure passage for small vessels from the waters of Virginia to those of North Carolina and farther south engaged the attention of the commercial and political leaders of Colonial times, and I have no doubt but that Washington entertained expectations of some such achievement in later years when he undertook the construction of the canal through the Dismal Swamp, for in his time the terrors of the passage around Cape Hatteras were far more real than they are to-day, since the character of the vessels passing this route are vastly different. Yet ships at present, with all the advantages which steam propulsion affords, are not exempt from shipwreck upon the numerous shoals which envelop, like a web, this dangerous, storm-infested cape.

Vessels sailing between ports which will permit of a course far removed from Cape Hatteras may experience no inconvenience from the difficulties attending navigation in its vicinity, but it is safe to say that there is not a navigator who has occasion to round this cape but experiences a decided feeling of relief when he is well beyond the dangers which beset it, and probably there is not one of these who has not wondered why the advantages which the landlocked waterways of such apparent amplitude and continuity between the Chesapeake Bay and Beaufort Inlet have not been taken advantage of to the certain relief of all navigation between the first-named bay and Onslow Bay, at least.

Superficially the task seems easy. It is only when the engineer applies the formulas of his profession to the problem that difficulties arise. But however formidable these difficulties may have appeared in the past, much that appeared impossible then, thanks to the wonderful advance in the mechanic arts, becomes possible to-day, and the consummation of this widely desired inland navigation between the North and the South approaches a condition of possible early achievement.

In determining the character of the work to be done, the nature of the commerce to be principally benefited has to be considered. The foreign commerce, since it requires the largest class of vessels, should be able to brave the dangers off Hatteras successfully, although, as a matter of fact, such vessels are from time to time wrecked in this vicinity. This interest is at present negligible, and will be of less importance as time passes.

The coastwise traffic, on the contrary, is of the first importance, and it is this commerce which is essentially national in character. Of the two classes of vessels engaged on this coastwise traffic, the large vessels which ply between widely separated ports could give the cape a wide berth; although during stormy periods a canal would be serviceable, generally the deep-sea water would be preferable, and the inland water route therefore unimportant. To the smaller class of vessels—

barges and similar craft—a safe inland water route, such as is called for in the act directing the examination under discussion, is invaluable.

The present navigable waterway has a limit of 8 feet depth to the Ocracoke Inlet and 6 feet to Beaufort. This depth is inadequate for the full realization of the navigation possibilities or requirements of the routes. The benefits which have attended the development of an 8-foot navigation warrant the belief that the greater benefits which will result from a 16-foot channel are sufficient to warrant the undertaking as certain to be a profitable financial investment.

As has been amply demonstrated upon the northern lakes, a depth of water which will permit the economic application of steam for the propulsion of freighters has resulted in the most extraordinary development of the country tributary to this navigation. Why should not a similar result attend the opening of an inland navigation of equal depth which is capable of extension from New York to Florida, and which would have direct connection with nearly all the navigable rivers which flow from the Allegheny Mountains to the Atlantic Ocean?

The safety from storms and disaster which such an inland route would afford would add greatly to the economy of transportation, and the economy of the transportation would invite commercial enterprises which at present are dormant, to the manifest disadvantage of the nation. As matters stand at present it is impossible to obtain any reliable statement of the extent of the commerce to be benefited. It is largely conjectural.

A firm in Norfolk had occasion to send a small shipment of coal to Fort Caswell, N. C., recently, and was unable to secure a better rate than \$1.25 per ton. A firm dealing in marble and granite in Norfolk is able to obtain granite from Vermont for much less than from North Carolina on account of the prohibitive freight rate from North Carolina, although the distance is much less.

I am informed that the coal supplied to Wilmington is charged with the freight rate to Norfolk and thence by rail, although it may come by a more direct route.

I am informed that the shippers of cotton in North Carolina would be equally benefited if they could ship in small quantities—less than a shipload—to Baltimore and Norfolk, since they would be saved losses on charters, owing to inability to furnish full loads at times. The lumber interest, which is large, would be greatly benefited by the reduced freight charges which would result from the use of larger barges towed by steam tugs.

A system of barges towed by steam tugs is certainly the cheapest method of transportation known at present, and it is reasonable to infer that the benefits to the coal consumers south of Norfolk would be greatly enhanced by the establishment of such a means of transportation.

The statistical information accompanying my preliminary report of August 10, 1900, gives in detail about all that I have been able to gather at this end of the proposed route.

As a means of coast defense in time of war, the possession of an interior waterway of the dimensions advocated is self-evident.

Although I have included the whole project in forming an argument for the consideration of the advisability of the contemplated improvement, I believe that so much of the route as is covered by my survey is, in view of its possible extension, worthy of improvement by the Government.

A letter from Mr. C. M. Kaylor, resident manager for the Virginia Iron, Coal, and Coke Company, at Norfolk, Va., is appended, and will indicate some of the prospective advantages to be derived from such an inland waterway and about the character of craft which will make use of it.

The resultant maps of the survey are not forwarded, as they were only made with a view to determining the estimated cost of the work, and are therefore of little interest.

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 21, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

The item in the emergency river and harbor law of June 6, 1900, authorizing this survey reads:

Pasquotank River: With the view of obtaining a navigable depth of sixteen feet at mean low water from South Mills, on the Pasquotank River, thence down the Pasquotank River, through Albemarle Sound, Croatan Sound, Pamlico Sound, and Core Sound, to Beaufort Inlet, including also cost of procuring a navigable depth of eighteen feet through Beaufort Inlet and eighteen feet through Ocracoke Inlet, respectively.

This report covers only a small part of the entire route, viz, that part north of Albemarle Sound, a distance of about $37\frac{1}{2}$ miles. The average cost of a 16-foot navigation is estimated at over \$51,000 per mile, and the annual cost of maintenance, although not estimated, will be considerable. The width of the proposed channel over portions of the route is, in my opinion, inadequate. The width should not in any part, and particularly in the "narrow and tortuous" part, be less than 150 feet.

This $37\frac{1}{2}$ miles being only one link in the chain of the proposed inland waterway, I am unable to give a definite opinion as to the amount of improvement which may be justified by the commerce involved until the report on the larger part of the route is made. This, I understand, will be made by Capt. E. W. Van C. Lucas. I do not, however, concur in the opinion of the district engineer that this $37\frac{1}{2}$ miles of the route alone is worthy of improvement by the General Government to the extent indicated. To my mind its improvement to a 16-foot navigation would be justified only when like improvements connecting the waters of the Chesapeake Bay with those of the southern limit of the project are made.

The opening of an inland waterway along the coast, avoiding Hatteras, is desirable both for commercial and military reasons. The entire waterway, however, should be under the control of the General Government. If the prescribed route is adhered to, that control would necessitate the purchase by the United States of the Dismal Swamp

Canal and then increasing the present depth of the latter from 10 feet to 16 feet and rebuilding the locks to correspond.

The Dismal Swamp Canal is a link in the chain, and if it is to remain the property of a private corporation that corporation would have the power to dictate the depth that could be made available. There is another canal connecting the waters of the Chesapeake Bay with Albemarle Sound—the Albemarle and Chesapeake Canal. To improve the approaches to one and leave those of the other in their natural state would practically destroy the unaided one, for commerce will always follow the better route. In my opinion the Government, before entering on a costly scheme for improving this inland waterway, should control the entire route.

The improvement of this route to the extent indicated in the law making provision for the survey is worthy of being undertaken by the General Government only in case the Dismal Swamp Canal is purchased by the United States for a reasonable sum and that the other links southward in the chain of the inland waterway can be similarly improved at reasonable cost.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

LETTER OF MR. C. M. KAYLOR, RESIDENT MANAGER AT NORFOLK, VA., FOR THE VIRGINIA IRON, COAL, AND COKE COMPANY.

VIRGINIA IRON, COAL, AND COKE COMPANY,
Norfolk, Va., November 16, 1900.

DEAR SIR: We beg to own receipt of your favor of the 2d instant, addressed to Toms Creek Coal and Coke Company, in regard to the projected canal from South Mills, N. C., to Norfolk. You will pardon us for not replying to your letter earlier. The writer has been absent from the city, hence the delay. We look upon this project as being very valuable to this place, as well as other localities along the route. We think the present shipments of coal from this port south could be very materially increased by virtue of having this inland waterway. We have found it exceedingly difficult to make charters for small cargoes going south of Hatteras, owing to the extreme danger of going outside.

There is considerable business that could be built up provided we could move coal in small cargoes, say 500 to 1,000 tons, or even less quantities, that we can not handle now. Our company had some experience along this line in the months of July and August in trying to fill an order for the Government at Fort Caswell. Our bids on this business were based on getting a water rate from Norfolk that would certainly not exceed the published rate from Baltimore to Wilmington. But after the business was accepted we found it absolutely impossible to secure transportation at any price, and we were forced to handle this coal by rail, at a very great loss to us, and should we have put in our bid with a view to delivering the coal by rail, as we had to do, it would have cost the Government 50 cents per ton more than it did. At this time there are from 30,000 to 40,000 tons of coal going to the West Indies each month from here. We are inclined to think that a considerable amount of this tonnage might be diverted through this canal and handled at a cheaper rate than we now have, with equally as good profits to the transportation companies. Should we be able to secure any additional information or statistics in regard to this matter, we will gladly furnish you with same.

We sincerely hope you will be able to get this matter through.

Yours, very truly,

VIRGINIA IRON, COAL, AND COKE COMPANY,
C. M. KAYLOR, *Resident Manager.*

MR. JAMES B. QUINN,
Major, Corps of Engineers, U. S. A.

SURVEY OF WATERWAY FROM ALBEMARLE SOUND, NORTH CAROLINA, TO BEAUFORT INLET, VIA CROATAN, PAMLICO, AND CORE SOUNDS, WITH THE VIEW OF OBTAINING A NAVIGABLE DEPTH OF 16 FEET AT MEAN LOW WATER, AND OF BEAUFORT AND OCRACOCKE INLETS WITH THE VIEW OF OBTAINING NAVIGABLE DEPTHS OF 18 FEET.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., November 22, 1900.

GENERAL: In compliance with instructions contained in letter from your office dated August 29, 1900, I have the honor to submit the following report, on that part south of 16-foot depth in Albemarle Sound, of survey between Pasquotank River and Beaufort Inlet.

This survey was authorized under the emergency river and harbor act of June 6, 1900, as follows:

Pasquotank River: With the view of obtaining a navigable depth of sixteen feet at mean low water from South Mills, on the Pasquotank River, thence down the Pasquotank River, through Albemarle Sound, Croatan Sound, Pamlico Sound, and Core Sound, to Beaufort Inlet, including also cost of procuring a navigable depth of eighteen feet through Beaufort Inlet and eighteen feet through Ocracoke Inlet, respectively.

This proposed inland route, as shown on map No. 1 herewith, is from the southern terminus of the Dismal Swamp Canal, via Pasquotank River, Albemarle, Croatan, Pamlico, and Core Sounds, to the Atlantic Ocean at Beaufort Inlet, with access to the ocean at Ocracoke Inlet. The distances are as follows: From South Mills, via Pasquotank River, Albemarle, Croatan, Pamlico, and Core Sounds, to the ocean at Beaufort Inlet, is 174 miles, of which 136 miles, included in the survey under my charge, has an aggregate of about 77 miles less than the proposed depth. The outlet at Ocracoke is 10 miles long and includes about 3.6 miles of channel less than the proposed depth. The proposed improvement, therefore, contemplates about 80 miles of dredged channels.

Surveys have been made of such parts of the inside route as are less than 16 feet, and of the ocean bar channels at Ocracoke and Beaufort inlets. The results are given on the accompanying maps, Nos. 2¹ and 3,¹ which show the location of the dredged channels necessary to obtain the contemplated depths. The field work was done by two working parties in about seven weeks' time, and covered about 200 square miles of hydrographic surveying.

Estimates are based on 300 feet width of channel, with side slopes 1 on 3. This width is deemed necessary because the entire channel lies in open sounds, exposed to strong side winds, which, in a narrow channel, are liable to swing barges in rear of tow against the shoal banks. The estimated yardage, lengths of cutting, and cost are as follows:

Albemarle Sound, 10.13 miles, 1,700,000 yards, at 10 cents	\$170,000
Croatan Sound, 10.59 miles, 3,600,000 yards, at 10 cents.....	360,000
Pamlico Sound, north end, 19.87 miles, 5,400,000 yards, at 10 cents.....	540,000
Pamlico Sound, Bluff Shoal, 2 miles, 550,000 yards, at 10 cents	55,000
Ocracoke Inlet, inside bar, 3 miles, 1,500,000 yards, at 10 cents.....	150,000
Ocracoke Inlet, ocean bar (18 feet depth), 0.6 mile, 450,000 yards, at 10 cents	45,000
Core Sound, 32.6 miles, 13,000,000 yards, at 10 cents.....	1,300,000
Beaufort Inlet (18 feet depth), 1.6 miles, 1,150,000 yards, at 10 cents	115,000
Two suction dredges for maintenance.....	200,000
Contingencies, 10 per cent	346,500

Total, 80.39 miles 3,811,500

¹Not printed.

In Albemarle and Croatan sounds clay, sand, and stumps may be expected and some form of clam-shell or endless-chain dredge will probably be needed, although an effective suction dredge with powerful cutters might be devised. In Pamlico and Core sounds the material is sand and mud mixed, which could be most economically handled with a suction dredge, combining the features of those used on the Mississippi River and the ordinary suction dredge used on ocean bars of the Atlantic coast, of which the *Cape Fear* is a type.

The price per yard, 10 cents, is believed ample, as with a small clam-shell dredge plant on the Cape Fear River, consisting of the dredge *Ajax*, 1 tug, and 3 scows, a total of 2,000,000 cubic yards has been dredged in three and a half years, at a cost of 8.14 cents per yard, including cost of plant and maintenance. The continuous channel from Albemarle Sound through Croatan Sound and the northern part of Pamlico Sound may well be handled with a clam-shell dredge of the new *Admiral* type, now working in Baltimore Harbor under contract price of about 8½ cents. The suction dredge *Cape Fear* has in five years dredged about 2,000,000 yards from the ocean-bar channel at a cost of 8.3 cents per cubic yard, including cost of plant and maintenance. A modification of this form could be used to advantage at Bluff Shoal, Core Sound, and inner shoals at Ocracoke, while a dredge of the *Cape Fear* type could be used at Beaufort and the ocean bar at Ocracoke.

Dredged channels in such exposed localities are certain to deteriorate, and provision should be made for systematic maintenance. As the deterioration will consist of sand filling, perhaps the most economical method of maintenance will be with one or more suction dredges of the *Cape Fear* type, the first cost of two of which is included in the above estimate, and the annual cost of operating will be about \$50,000.

In my opinion it is not now necessary to open both Ocracoke and Beaufort inlets, as a single route will probably be sufficient for all present needs. The distance from South Mills to Ocracoke Bar is 128 miles, of which the 90 miles covered in my survey includes about 44 miles with less than proposed depth. The cost of improving this route to proposed depth, omitting Beaufort, is estimated at—

12,650,000 yards, at 10 cents.....	\$1,265,000
Two suction dredges for maintenance	200,000
Superintendence and contingencies, 10 per cent.....	146,500
Total	1,611,500

The distance from South Mills to Beaufort Inlet Bar is 174 miles, and the 136 miles covered by this survey includes about 77 miles of channel less than the proposed depth. The estimated cost of improving this route to proposed depth, omitting Ocracoke, is—

30,700,000 yards, at 10 cents.....	\$3,070,000
2 suction dredges for maintenance	200,000
Superintendence and contingencies, 10 per cent.....	327,000
Total	3,597,000

Either the Ocracoke or Beaufort route will avoid Cape Hatteras, and the Ocracoke route has the decided advantage of costing less than half the cost of the Beaufort route; but it has the greater disadvantage of an outlet north of Cape Lookout, which, while not as dangerous as Hatteras, is still a serious menace to navigation, as shown by the estimated loss at that place of \$2,600,000 in vessels and cargoes during the nine years up to 1897 (see report on Cape Lookout Harbor of Refuge,

printed in House Doc. No. 25, Fifty-fifth Congress, second session).¹ The Ocracoke route has the further disadvantage of a southern terminus at an isolated fishing village which can never have railroad connections.

The Beaufort route has apparently the single disadvantage of greater cost, while its advantages over the Ocracoke route include (1) the very important one of avoiding Cape Lookout; (2) its proximity to Lookout Bight, where the establishment of a harbor of refuge has been contemplated for several years (see House Doc. No. 80, Fifty-sixth Congress, first session²), and (3) its railroad terminus at Morehead City, just within the inlet. A harbor of refuge so near (7 miles) Beaufort Inlet would be a safeguard for vessels approaching the inlet to take the inland route when the weather is bad and the sea so heavy as to make passage of the inlet dangerous. The improvement of Beaufort Inlet will tend to develop Morehead City as a shipping point, and its railroad connection will permit the establishment there of machine shops and other necessities for refitting and repair.

Commercial statistics.—This inland waterway, if established, will affect the commerce of all South Atlantic ports, which consists of both foreign and coastwise shipments. The former need not be considered, as they are carried mainly in large steamers or sailing vessels which draw more than the proposed depth of the waterway and are equipped to weather heavy storms. Such vessels would hardly take advantage of the inside route.

The coastwise commerce is carried by steamers and sailing vessels, but not in seagoing barges, which can not be successfully used under existing conditions because of the dangers and delays incident to passing Cape Hatteras.

Steamers, as a rule, would not seek the inland route, as the gain in time by going outside more than compensates for the greater risk.

Sailing vessels are uncertain as to time, and would probably gain on a northwardly trip by being towed through Core Sound, sailing through Pamlico, Croatan, and Albemarle sounds, and being towed thence through the canal to Chesapeake Bay.

Seagoing barges can not under existing conditions be used for the commerce of the South Atlantic coast, as every effort to that end has conclusively demonstrated the prohibitory effect of the dangers and delays incident to passing Cape Hatteras. The South Atlantic ports are, therefore, at present debarred from using what is generally conceded to be the cheapest known form of transportation, which fact, in my opinion, constitutes the strongest argument in favor of establishing an inland waterway from Chesapeake Bay to Beaufort Inlet.

The value of the interests affected is very large, and the following estimates are submitted as a safe approximation to the probable amounts. They are believed to be fairly conservative and probably less than the amounts more accurate estimates would show. For instance, Savannah's coastwise traffic, mostly to and from North Atlantic ports, was in 1899 valued at about \$94,000,000 (annual report, mayor of Savannah, 1899), and less than half that amount is given as Savannah's share of the commerce liable to be affected by the establishment of the inland waterway.

¹ Printed in Annual Report of Chief of Engineers for 1897, page 1430 et seq.

² Ibid. 1900, page 1829 et seq.

Estimated value of coastwise commerce liable to be affected by the establishment of inland water route to avoid Cape Hatteras.

Wilmington, N. C	\$15,000,000
Georgetown, S. C	3,075,000
Charleston, S. C	35,000,000
Savannah, Ga	43,885,000
Brunswick, Ga	9,000,000
Fernandina, Fla	1,214,000
Jacksonville, Fla	9,000,000
Total	116,174,000

The above estimates cover cotton, lumber, naval stores, phosphates, coal, and general merchandise of a bulky character that could stand shipment by barge, and will probably aggregate from 5,000,000 to 10,000,000 tons annually. It is therefore probable that the proposed inland waterway, at an outside cost estimated at nearly \$4,000,000 for the part under consideration, will benefit a commerce amounting to at least \$115,000,000 annually, which would seem to indicate that it is a worthy improvement. The general manager of the bureau of freight and transportation at Charleston, S. C., thinks its effect would be much greater, as he states:

It will not only give lower rates on lumber, naval stores, cotton, coal, etc., but will also be the means of reducing rates from the Western cities on all kinds of freight, of which the principal commodities are grain and its products, packing-house products, iron, bar iron, and innumerable other kinds of goods supplied by the West to the Southeast. This is true because the rates from the West to South Atlantic ports base on the rates from the Western cities to Norfolk plus the rail rate from Norfolk to Charleston.

This possible effect on rates from Western cities to the South Atlantic coast is a very intricate question, and one difficult to determine justly; but the general argument is that as such rates are based on the rate to Norfolk plus the rate from Norfolk south, a reduction of rates between Norfolk and the South will reduce the total rates between Western cities and the South Atlantic coast.

Conclusions.—That such an inland waterway as above described will be a very valuable acquisition to the country, and particularly to the South, will hardly be denied, and the only serious objection is its great cost. It remains, therefore, to determine whether or not the arguments in its favor are sufficient to warrant so great an expenditure.

These favorable arguments may be summarized as follows:

First. It will promote the establishment of barge transportation between South Atlantic and Northern ports, with a probable consequent reduction of freight charges. On the estimated tonnage affected—say 5,000,000 tons annually—an average reduction of only 10 cents per ton would amount to \$500,000, which, at 5 per cent, is the interest on \$10,000,000, nearly double the total cost, including that part north of Albemarle Sound. In confirmation of the belief that reduced freight rates will follow the introduction of barge transportation is the fact that since its introduction in the coal trade from Chesapeake Bay north the freight rates have been reduced more than half, and where a few years ago they amounted to from \$3 to \$5 per ton they are now from 75 cents to \$1.50 per ton.

Second. There will be a probable material reduction in insurance rates on coastwise freights, due to the elimination of the most dangerous part of the route. Marine insurance from this port to New York is, by steamer one-fourth of 1 per cent and by sailing vessel an

average of about three-fourths of 1 per cent. The lower rate on a total commerce of \$115,000,000 annually amounts to about \$287,500, which does not include the insurance on the vessels themselves.

Third. The inland waterway would afford an interior line of communication in time of war for transportation of supplies and for naval operations by light-draft vessels, such as torpedo boats and destroyers. Its value for such purpose can hardly be estimated, being similar to that of seacoast fortifications, which are rarely actually needed, but when the need arises it is most acute.

Fourth. There would be a probable large development of the country along the route of the proposed waterway, such as has followed other similar improvements. This, of course, can hardly be estimated.

Fifth. It would result in the establishment of a most important link in the chain of inland waterways that will eventually extend from the New England coast to Florida.

In this connection attention is respectfully invited to the accompanying letters bearing on the subject, particularly that of W. B. Brooks, jr., president of the Dismal Swamp Canal Company, whose interest in that canal has led to his making a close study of the subject. His statement—

I speak officially when I say that in the event of the Government improving its inland waterway the present owners of the Dismal Swamp Canal route will provide the means of deepening and widening their canal to any extent required to meet the traffic which will naturally seek this safe and protected route,

has an important bearing on the treatment of the whole question, as the project outlined in the act of June 6 does not give a through waterway, but only the part from the southern terminus of the Dismal Swamp Canal to Beaufort. Without a corresponding improvement of either the Dismal Swamp Canal or the Albemarle and Chesapeake Canal the improvement above outlined would be nearly useless.

A conclusion can hardly be arrived at, nor a recommendation made, without considering that part of the work north of Albemarle Sound, the estimates for which are submitted by Maj. J. B. Quinn, Corps of Engineers. Assuming, however, that that part of the project can be done at a cost not exceeding \$2,000,000, the entire waterway, from the southern end of Dismal Swamp Canal to Beaufort Inlet and the ocean, can be obtained at a probable expenditure of about \$5,500,000, with an annual cost thereafter for maintenance of from \$50,000 to \$100,000. Such expenditure will benefit a commerce now estimated at about \$115,000,000 annually, with a probable rapid increase.

For the reasons above stated I am of the opinion that the proposed improvement is a worthy one, and I recommend that it be undertaken by the United States. In my opinion, however, the Government should not commit itself to so large an expenditure without a very clear understanding as to the treatment of either or both of the canals at the northern end. To establish a free through waterway would involve the purchase of one of these canals and its improvement to 16 feet depth. To improve the waterway to one canal and not to the other would give the former a virtual monopoly and leave the commerce desiring to use the waterway more or less at its mercy. Finally, if neither canal is to be purchased by the Government, there should be absolute assurance that one or both canals will be deepened to 16 feet; otherwise the value of the proposed improvement will be very largely lessened.

While not within the scope of the proposed improvement outlined in the act of June 6, the object of the improvement—to establish a 16-foot waterway to Beaufort Inlet—can not be fully considered without reference to the possibility of improving the Clubfoot and Harlowe Canal route, instead of the Core Sound route, as a connecting link between Pamlico Sound and Beaufort Harbor.

Starting from a given point at Bluff Shoal, the distance to Beaufort Inlet sea bar is, via Core Sound, 56 miles, of which 34 miles must be dredged, and via Clubfoot and Harlowe Canal 66 miles, of which 18 miles must be dredged. The apparent advantages of the Clubfoot and Harlowe route are 14 miles less of dredged channel and the fact that the dredged channel necessary will be landlocked so that its width may be decreased to about 100 feet, or one-third of that necessary through Core Sound. An apparent disadvantage of the Clubfoot and Harlowe route, as compared with the Core Sound route, is the greater average depth of dredging. An absolute comparison of the two routes can, however, only be made after a survey of the Clubfoot and Harlowe route, which was not authorized by the act of June 6, but such necessary investigation could be completed within a few weeks and need not delay the beginning of this important work, if otherwise deemed advisable.

There are forwarded herewith three tracing¹ showing proposed routes and depths of water where dredging will be necessary. Of these, map No. 2, showing Croatan Sound and approaches in Albemarle and Pamlico sounds, has the triangulation in red, which color was used to avoid confusion. The triangulation scheme is submitted for possible future use, but there is no apparent necessity for either photolithographing or blue printing it.

Very respectfully,

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., December 1, 1900.

Respectfully submitted to the Chief of Engineers, United States Army, and reference requested to my indorsement, dated November 21, 1900, on the report of Maj. James B. Quinn, Corps of Engineers, on the northern part of this route, dated November 17, 1900.

The opinion expressed in that indorsement—that the United States should not undertake this work without controlling the whole route from end to end—is reiterated with additional emphasis. The corporation controlling the Dismal Swamp Canal can at any time dictate the depth to be made available for navigation, and also the draft and beam of vessels using this whole waterway. In my judgment, something more is necessary than a mere statement from the president of the company that means will be provided for giving increased dimensions to the canal before the United States commits itself to the

¹ Not reprinted; printed in House Doc. No. 202, Fifty-sixth Congress, second session.

expenditure of several millions of dollars for this improvement. While there is a link in the chain of waterways between the Northern and Southern States controlled by private interests there is a menace to the utility of the whole route, and this danger may at any time be greater from inability than from indisposition. It would be in the power of the corporation to blockade the whole route by delaying repairs to a break in its canal or its locks. The question of water supply to the summit level, which has not been considered in this report, might make the depth needed impracticable of realization.

It is within the range of possibility that if this waterway be constructed by the United States it may some time in the future become desirable for military reasons, if not for commercial ones, to increase the dimensions of the navigable channel. In that event the corporation controlling the Dismal Swamp Canal could not be expected to anticipate a revenue from the military operations alone sufficient to justify the expenditure of a sum to make this link correspond in dimensions with the other parts of the waterway desired by the United States. Nor is the General Government confined to this specific route for an inland waterway connecting the Chesapeake Bay with Beaufort Inlet. A route via the Albemarle and Chesapeake Canal, and thence through Currituck Sound and a continuance by the route prescribed by the law, is available and should be considered if the United States is to do the work.

Both Cape Hatteras and Cape Lookout are dangerous to navigation, differing only in degree. To provide a waterway that will avoid Hatteras and cause the vessels using it to round Lookout would be only a partial and insufficient relief. A waterway with its southern outlet at Ocracoke Inlet is not as desirable as one with its southern limit at Beaufort, because of the menace to navigators at Lookout. In my opinion, therefore, that part of the route prescribed by the law and reading "including also cost of procuring a navigable depth of * * * eighteen feet through Ocracoke Inlet" is not worthy of being undertaken by the General Government in connection with the waterway now under consideration.

The estimate of the district engineer has an item of \$200,000 for the construction of two suction dredges for maintenance. I do not believe it wise at this time to prescribe the type of dredges to be built at some future time to maintain a channel 174 miles long, varying in different parts in the character of the material to be removed. I advise that while retaining the amount of the estimate the model of the dredges and the number of them be left undetermined until the work of construction has developed the character of material that will be handled in the operations for maintenance.

To sum up the estimate for the whole route of 174 miles in accordance with this indorsement and my previous one on Major Quinn's report, the following is found, except that the estimate of the latter should be increased correspondingly to my recommendation that "the width should not in any part, and particularly in the narrow and tortuous part, be less than 150 feet:"

From South Mills to Albemarle Sound.....	\$1, 935, 893. 62
Through Albemarle Sound to Beaufort Inlet Bar, excluding the route through Ocracoke Inlet.....	, 597, 000. 00
Total.....	5, 532, 893. 62

The above includes a dredging plant for maintenance, and in my opinion the plant provided for will be sufficient for the whole route.

The estimate of the district engineer for maintenance should be \$100,000 annually at least.

This survey is for a project of great national importance, and should be undertaken only after the most careful consideration and study to see that the best route is adopted. I do not think the surveys thus far made determine this fact with certainty. This survey is for a particular route described in the law, leaving the engineer no discretion in the selection of a better one, should it exist. There are other routes that should be examined and the best connection made between Albemarle Sound and Chesapeake Bay, whether it be via the Dismal Swamp Canal or the Albemarle and Chesapeake Canal. Moreover, the entire route should be owned by the United States.

I am clearly of the opinion that an inland waterway should be opened by the United States from Norfolk south, that it should be under the absolute control of the United States from one end to the other, and that the Government would be justified in expending a considerable sum on such a work, but I think it very doubtful whether or not the route or depth prescribed in the law under which this survey is made is the best to be adopted.

In view of the above, and while I consider the work as worthy of being undertaken by the General Government, I am of the opinion that further surveys should be made to determine the best route and the most desirable width and depth.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer Southeast Division.*

LETTER OF THE GARDNER & LACEY LUMBER COMPANY.

GARDNER & LACEY LUMBER COMPANY,
Georgetown, S. C., November 6, 1900.

DEAR SIR: We are in receipt of yours of the 1st instant, requesting information as to the approximate amounts in values of exports and imports from this port which would be affected by the establishment of a canal connecting the Norfolk canals with some point on the Atlantic coast south of Hatteras, to have a mean depth at low water of not less than 16 feet.

In reply we beg to say that our output annually runs from 12,000,000 to 15,000,000 feet, with an average valuation of about \$250,000, amounting to approximately 20,000 tons. Of this amount, we ship now about two-fifths by rail. Should such a canal as you speak of be established there is not the slightest doubt in our minds that nine-tenths of our output would go forward from here by water, since the danger and risk attendant upon a trip around Hatteras results in exorbitant charges for freight room to Northern points. We are at the present time offering \$6 to Boston, \$5.50 to New York, and \$4.50 to Baltimore, and we can ship by rail to Baltimore at a rate very little more. With the reduced rate which we are certain could be secured with such facilities, most of our rail shipments which go to points in the interior in New England would go by water and be reshipped from water points along the New England coast at a total rate of freight which would be a material reduction over the very large rail rate which we are now forced to pay.

The chief factor in reducing this water rate, outside of the reduction in risk, would seem to us to be the great saving in expense by the providing of large barges, which can be run with a very small crew in tows taking two or three at a time from this and other Southern ports north.

Trusting that this information will answer your requirements, we are.

Yours, very respectfully

GARDNER & LACEY LUMBER COMPANY,
F. B. GARDNER, *Secretary.*

REID WHITFORD, Esq.,
United States Assistant Engineer, Georgetown, S. C.

LETTER OF THE ATLANTIC COAST LUMBER COMPANY.

ATLANTIC COAST LUMBER COMPANY,
Georgetown, S. C., November 6, 1900.

DEAR MR. WHITFORD: In compliance with your request of November 1, I would state that should an inland canal be provided by the United States Government of 16 feet depth at low water from the Norfolk canals to a point on the Atlantic coast south of Cape Hatteras our shipments by this route would be, approximately, as follows:

One hundred and fifty million feet of lumber per annum, or 225,000 tons, north bound; approximate value at Georgetown, \$1,500,000. I think it is safe to figure the back tonnage at one-fourth the above, making, say, 60,000 tons; approximate value, \$1,200,000, or a total tonnage, north and south, of 285,000 to 300,000 tons, and a total value of \$2,700,000 to \$3,000,000.

The present rate of freight on lumber to Baltimore is \$4 per thousand feet, to New York \$5, and to Boston \$6, while during the past winter the freights to New York were as high as \$7, and to Boston \$8.50.

A canal of this character would be of great benefit to all shipping having to round Hatteras, inasmuch as it would reduce the risk to shippers and vessel property and would materially reduce the rate of freight and rate of insurance between Southern and Northern ports.

If such a waterway could be established this commerce could be handled largely through tug and barge systems. Shipping for coastwise freights is very scarce. A great many of the small vessels which were in this trade a few years ago have been destroyed, and these have not been replaced. In our business we have been compelled to build steel steamers with a draft of 15 feet, because of the scarcity of coastwise vessels in commission. If such a waterway were established it would be a great relief to us, even with these steel steamers, to have them go inland rather than around Hatteras; and it goes without saying that the same advantage would accrue to all coastwise commerce and shipping originating and terminating south of Hatteras.

Yours, very truly,

ATLANTIC COAST LUMBER Co.,
By E. B. FREEMAN, *Vice-President.*

MR. REID WHITFORD,

United States Assistant Engineer, Georgetown, S. C.

LETTER OF THE SOUTHERN PINE COMPANY OF GEORGIA.

SOUTHERN PINE COMPANY OF GEORGIA,
Savannah, Ga., November 19, 1900.

DEAR SIR: Replying to your favor of November 16, the current rates of freight on lumber from Savannah to Northern ports are—

	Per M. feet.
To Baltimore	\$5.00
To Philadelphia.....	5.50
To New York.....	5.50
To Sound ports.....	5.75
To Boston.....	6.00

The rates to Philadelphia and New York are likely to advance in the near future, owing to ice in those ports, particularly Philadelphia.

There would be marked advantages to the trade if a barge route, partly inland, could be provided. Regardless of any difference in rate that might be brought about, the advantages of more prompt and certain times of delivery would be manifold, and should such a route be provided it would undoubtedly be promptly taken advantage of.

Yours, very truly,

SOUTHERN PINE CO. OF GEORGIA,
WM. B. STILLWELL, *Secretary.*

CASSIUS E. GILLETTE, Esq.,

Captain of Engineers, U. S. A., Savannah, Ga.

LETTER OF MESSRS. E. B. HUNTING & CO.

E. B. HUNTING & Co.,
Savannah, Ga., November 19, 1900.

DEAR SIR: We have yours of the 16th instant, and contents carefully noted. The freight on lumber fluctuates largely, according to the demand. Just at the moment we are paying \$5.75 per M feet to New York, \$5.25 to Philadelphia, \$5 to Baltimore; Boston and Portland, about \$6.

We believe if the inland route could be traversed by a barge, it would be a great thing and would reduce the sail freights very materially.

This question has been agitated, and we look to see it put into operation before very long. Any information that we can give you, will be glad to do so.

Yours, very truly,

E. B. HUNTING & Co.

Captain GILLETTE,
Savannah, Ga.

LETTER OF MESSRS. GRANTHAM I. TAGGART & CO.

GRANTHAM I. TAGGART & Co.,
Savannah, Ga., November 19, 1900.

DEAR SIR: Replying to your favor of the 16th instant, would say that freight rates vary 75 cents to \$1.50, flat, from Northern ports. We would estimate the average freight rate to be from 90 cents to \$1, flat, by sailing vessels.

Yours, truly,

G. I. TAGGART & Co.

Capt. C. E. GILLETTE,
Corps of Engineers, Savannah, Ga.

LETTER OF THE HERMAN COAL AND WOOD COMPANY.

HERMAN COAL AND WOOD COMPANY,
Savannah, Ga., November 19, 1900.

DEAR SIR: We are in receipt of yours of the 17th instant, and note contents.

In reply beg to say that it has been our custom to average freight rates at \$1 per ton, per sailing vessels, the year around.

We do not think that we would save any money by bringing our coal in barges, as the towage, we think, would be as heavy as the rate we are now paying.

Yours, very truly,

HERMAN COAL AND WOOD Co.
By CARL J. HERMAN.

Capt. C. E. GILLETTE, City.

LETTER OF MESSRS. ALEXANDER SPRUNT & SON.

ALEXANDER SPRUNT & SON,
Wilmington, N. C., October 27, 1900.

DEAR SIR: With reference to your request of October 22 for our opinion regarding the advantages which might accrue to our business interests by the establishment of barge transportation between the South Atlantic ports and the ports north of Cape Henry, through an inland waterway now projected by the General Government, we respectfully reply that we believe such a convenience would be of immense advantage to our cotton and lumber trade.

A certain reduction in freight charges would probably divide our own present large business of 250,000 bales of cotton annually shipped by our firm direct to Europe from Wilmington, and enable us to take advantage of close connection with faster trans-Atlantic steamers in Northern ports at lower rates of freight.

Under our present system we are obliged to charter ten to twenty steamers weeks ahead, in order to move our shipments promptly as they come to us from the interior by rail, at the rate of 3,000 to 4,000 bales per day during the busy season, in conse-

quence of which we incur the risk of a decline in direct trans-Atlantic freight rates, which often hampers our business. This disadvantage would be measurably overcome by barge transportation from Wilmington to Northern ports, where we could make freight engagements daily as required, and also gain the benefit of Northern connections with minor ports abroad for small shipments of 100 to 500 bales of cotton, which are now inhibited by excessive intermediate rates of freight.

The chief disadvantage of distance and danger in Frying Pan Shoals might be overcome by a short canal of 10 or 12 miles, from a point in Cape Fear River on the Northeast Branch, 30 miles above Wilmington, to Topsail Inlet, which is the best inlet on our coast between Beaufort and Wilmington. Such a connection would be a great boon to Wilmington, Georgetown, Charleston, Savannah, and other South Atlantic ports, and it would also make Wilmington of tenfold greater importance commercially than it is at the present time.

Yours, faithfully,

ALEX. SPRUNT & SON.

Capt. E. W. VAN C. LUCAS,
Corps of Engineers, U. S. A.

LETTER OF THE BUREAU OF FREIGHT AND TRANSPORTATION OF THE CITY OF CHARLESTON, S. C.

BUREAU OF FREIGHT AND TRANSPORTATION OF CITY OF CHARLESTON,
Charleston, S. C., October 23, 1900.

DEAR SIR: * * * If the opening up of inland navigation through Pamlico and Albemarle sounds will insure barge transportation to South Atlantic ports, it will be of untold benefit to all the ports which can be reached by the barge lines. It will not only give lower rates on lumber, naval stores, phosphate, and cotton shipped to Northern ports, and on coal imported from such ports, but it will also be the means of reducing rates from the Western cities on all kinds of freight, of which the principal commodities are grain and its products, packing-house products, iron, bar iron, and innumerable other kinds of goods supplied by the West to the Southeast. This is true because the rates from the West to the South Atlantic ports base upon the rates from the Western cities to Norfolk, plus the rail rate from Norfolk to Charleston. We have been striving for a long time to break down this system of rates and to have our rates from the Western cities made the same as Norfolk or approximately the Norfolk rates.

* * * * *

Yours, truly,

JOHN A. SMITH.

Capt. E. W. VAN C. LUCAS,
United States Engineer Office.

LETTER OF THE LAKE DRUMMOND CANAL AND WATER COMPANY.

BALTIMORE, *November 14, 1900.*

DEAR SIR: Referring to the question of the value of an inland waterway to the coastwise commerce, there are several facts that lead me to believe that the Government, in undertaking such a piece of work, would be amply repaid in the results:

First. It is a well-established fact that Hatteras is the most dangerous point on the Atlantic coast.

Second. A large number of the vessels undertaking to go by this point are wrecked year after year.

Third. An inland waterway of sufficient depth to take care of smaller vessels would be utilized as a means of avoiding Hatteras.

Fourth. That there has been a revolution in freight rates by large reductions since the use of barges drawn by tugboats has been employed.

Fifth. That in the event of war between this Government and any foreign power the use and value of such an inland waterway is self-evident in the advantages that would accrue by a protected and safe channel along the coast.

Sixth. That the largely increasing traffic between the Southern cities and the North demands the adoption of the cheapest and safest means of transportation.

Seventh. Efforts that have been made by private corporations have already developed a large trade between Northern points and Pamlico and Albemarle sounds.

Referring to the points above mentioned:

First and second. The dangers of Hatteras are so widely known, and more particularly by mariners, that there is no necessity of dwelling on this point further than to say that there has been a statement made that 17 per cent of the vessels trading along the coast are wrecked at this point. Not only is it dangerous to life and loss of property, but it is also a point of detention, owing to the combating winds that prevail.

Third. It is very evident, therefore, that if a suitable route could be obtained inland this menace to life and property could be avoided and the advantages of every mode of transportation by water could be availed of. The survey now being made will produce sufficient light to show whether the amount required for the construction would prove a paying investment.

Fourth. It has been demonstrated that the adoption of carrying freight on barges drawn by tugboats is probably the cheapest means of transportation developed up to this period, and there could be evidence produced where this mode of transportation has reduced the rates in many instances one-half, and in the case of bulky matter, such as lumber, coal, etc., it has reduced the price considerably more than one-half. For instance, the rate on coal from Baltimore to the New England States, when carried by steamers or sailboats, was from \$3 to \$5 per ton. The same coal is now being delivered at these points at from 75 cents to \$1.50 per ton. It is therefore evident that if the points on the coast south of Hatteras were in a position to utilize this means of freighting there would be a large volume of money saved. Several times individuals have tried the experiment of freighting lumber by barges from Savannah to Northern points, but they always gave it up, owing to the risk and losses occasioned by Hatteras. Therefore, with an inland route sufficient to carry barges with a draft of, say, 15 feet, there can be no doubt that this means of transportation would be speedily adopted, and I believe it could be clearly shown that there will be more than enough money saved in this manner (and also in the stoppage of loss of property by small sailing vessels undertaking to go south by the outside route) to pay a handsome interest on the amount expended on construction.

Fifth. The value to the Government does not need any enlargement, and I quote from a letter of General Craighill, ex-Chief of Engineers: "Its present importance can not be overestimated as well from a military as a commercial standpoint." The experience of our naval officers and men who undertook to take the torpedo boats south during the late war with Spain would clearly show the necessities of the construction of an inland route, both from the standpoint of safety and dispatch.

Sixth. The growth of our country is not confined to any one section, and within the last ten years the South has made tremendous strides in increasing its business, and the reports of the various coast cities in nearly every instance show an increase of traffic which clearly entitles that section to the benefits of all economical changes that have taken place, and this growing increase only makes it more important that there should be some move made to provide that section with the means of effecting these economies.

Seventh. At present there are two canals leading from the inland sounds of North Carolina and Virginia which have largely proved the value of inland navigation. Recently the old Dismal Swamp Canal has been reconstructed, and this route is being availed of by all of the larger vessels trading in that section. The saving to commerce by the improvement of this canal is very marked. The difference in the depth of drafts allowed vessels since the reconstruction of the Dismal Swamp route is about 2 feet. This 2 feet more than pays the toll charges of these vessels, avoids the reloading of the vessels in Norfolk, which has always been required prior to this time, and is a saving to commerce of 50 cents a ton on the product being carried out of that section.

I speak officially when I say that in the event of the Government improving its inland waterway, the present owners of the Dismal Swamp Canal route will provide the means of deepening and widening their canal to any extent required to meet the traffic which will naturally seek this safe and protected route.

Anyone taking the map and glancing along the Atlantic coast will see how nature has provided a safe course almost the entire distance from Massachusetts to Florida, and I thoroughly believe that the carrying out of the project contemplated will be the first link in the chain that nature has provided and which only required a comparatively small outlay to make a work that will be a blessing to future generations.

Yours, very truly,

W. B. BROOKS, Jr.

Capt. E. W. VAN C. LUCAS.

L 18.

EXAMINATION AND SURVEY OF SCUPPERNONG RIVER, NORTH CAROLINA.

[Printed in House Doc. No. 131, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY,

Washington, November 30, 1900.

SIR: I have the honor to submit herewith copies of reports, dated August 8 and November 17, 1900, by Capt. E. W. Van C. Lucas, Corps of Engineers, upon preliminary examination and survey, respectively, of Scuppernong River, North Carolina, with a view of improving the bar at the mouth emptying into Albemarle Sound, to the end that the channel be dredged 1,200 feet long, 150 feet wide, with 9 feet depth of water at mean low tide, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

In the opinion of Captain Lucas, concurred in by the Division Engineer, Col. Peter C. Haines, Corps of Engineers, this river is worthy of improvement by the General Government, and a project for dredging a channel 3,400 feet long, 9 feet deep, and 150 feet wide across the bar, estimated to cost \$14,000 if done with Government plant and hired labor, or \$30,000 if done by contract, is presented.

Very respectfully, your obedient servant,

JOHN M. WILSON

*Brig. Gen., Chief of Engineers,**U. S. Army.*

Hon. ELIHU ROOT,

Secretary of War.

PRELIMINARY EXAMINATION OF SCUPPERNONG RIVER, NORTH CAROLINA, WITH A VIEW TO IMPROVING THE BAR AT THE MOUTH BY DREDGING A CHANNEL 1,200 FEET LONG, 150 FEET WIDE, AND 9 FEET DEEP AT MEAN LOW TIDE.

UNITED STATES ENGINEER OFFICE,

Wilmington, N. C., August 8, 1900.

GENERAL: In compliance with instructions contained in letter from your office, dated July 9, 1900, I have the honor to submit the following report of preliminary examination of Scuppernong River, North Carolina, with a view of improving the bar at the mouth of Scuppernong River, emptying into Albermarle Sound, North Carolina, to the end that the channel be dredged 1,200 feet long, 150 feet wide, with 9 feet depth of water at mean low tide.

The navigable part of this river, 18 miles long, extends from Spruills Bridge, near Creswell, Washington County, through western part of Tyrrell County, N. C., to its mouth in Albermarle Sound, which it enters from the south shore about 20 miles east of Roanoke River light. Its course lies 15 to 25 miles from the nearest railway, and it forms the only practicable highway for shipments to and from a considerable section of good farming and timber country.

An examination made in 1894 (see p. 1360, Annual Report Chief of Engineers, 1895), in which I took part as assistant to Maj. W. S. Stanton, Corps of Engineers, resulted in an unfavorable recommendation as to somewhat more work than now contemplated. The annual commerce was then estimated at about 23,000 tons, which included 2,056

tons transported by the Norfolk and Southern Railroad Company's steamer.

It is estimated that the present annual commerce is more than double that of 1894, the part handled by steamer alone having increased from about 2,000 tons in 1894 to nearly 38,000 tons in 1899-1900. The increase is general and covers farm products, miscellaneous freight, and lumber.

The development of this country depends mainly on the successful navigation of the river, and two regular steamers now make triweekly trips, while barges carry away upward of 15,000,000 feet of manufactured lumber and 5,000,000 shingles annually, in addition to perhaps \$50,000 worth of juniper logs. Two new lumber mills have recently been built and the juniper-log industry is rapidly growing, so that a substantial increase over the present commerce may be expected in the near future.

This business is all handicapped by lack of water on the bar at the river mouth, the present depth on which is not more than 6 feet in a very narrow channel, and which is liable to decrease 2 feet or more during the prevalence of westerly winds.

The regular steamers are frequently delayed outside the bar, as are the tugs used for towing barges, and the barges used are limited to 6 feet draft, at least 2 feet less than the limiting draft for barges running out through canals to Norfolk, with consequent increase in cost of transportation charges for this locality.

Partial relief could be obtained by building steamers drawing 4 feet or less, but such light-draft vessels are not suitable for navigating the open sound, and would not be available for use elsewhere.

Ample relief can be obtained at comparatively small cost by dredging the desired channel, and such work will place this river on an equal footing with other streams in the vicinity.

For reasons above outlined, I am of the opinion that this river is worthy of improvement by the General Government, commerce interested being general (interstate) in character, and sufficient to warrant the probable expense.

The estimated cost of making the necessary survey and estimates is \$300, and an allotment of that amount is recommended from funds appropriated by act of June 6, 1900, no available balance from any former appropriation being available.

Very respectfully,

Brig. Gen. JOHN M. WILSON,

Chief of Engineers, U. S. A.

(Through the Division Engineer.)

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 10, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

I concur in the opinion of the district engineer that the bar is worthy of improvement by the United States, and his proposition for a survey is recommended for approval if funds are available.

* * * * *

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,

U. S. ARMY,

August 16, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Scuppernong River, North Carolina (full text of item quoted within), made to comply with the provisions of the emergency river and harbor act of June 6, 1900.

The stream is reported to be worthy of improvement, and I recommend that a survey be made and the cost of improvement be estimated.

JOHN M. WILSON,

*Brig. Gen., Chief of Engineers,**U. S. Army.*

[Third indorsement.]

WAR DEPARTMENT,

August 17, 1900.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN C. SCOFIELD,

Chief Clerk.

SURVEY OF SCUPPERNONG RIVER, NORTH CAROLINA, WITH A VIEW TO IMPROVING THE BAR AT THE MOUTH BY DREDGING A CHANNEL 3,400 FEET LONG, 150 FEET WIDE, AND 9 FEET DEEP AT MEAN LOW WATER.

UNITED STATES ENGINEER OFFICE,

Wilmington, N. C., November 17, 1900.

GENERAL: In compliance with instructions contained in letter from your office, dated August 25, 1900, I have the honor to submit the following report on proposed improvement of Scuppernong River, North Carolina.

This survey was authorized under the emergency river and harbor act of June 6, 1900,

with the view of improving the bar at the mouth of the Scuppernong River, emptying into Albemarle Sound, North Carolina, to the end that the channel be dredged one thousand two hundred feet long, one hundred and fifty feet wide, with nine feet depth of water at mean low tide.

The navigable part of this river, 18 miles long, extends from Spruill's bridge, near Creswell, Washington County, through the western part of Tyrrell County, to its mouth in Albemarle Sound, which it enters from the south shore about 20 miles east of Roanoke River light. Its course lies 15 to 25 miles from the nearest railway, and it forms the only practicable highway for shipments to and from a considerable section of good farming and timber country.

An examination made in 1894 (p. 1360, Report Chief of Engineers, 1895) resulted in an unfavorable recommendation on a project including the improvement of the bar, as above, in addition to snagging the upper river and modifying sharp bends. The commerce at that time amounted to about 23,000 tons annually, principally farm products, general merchandise, rafted timber, and shingles. Since then shipments of farm products and general merchandise have increased nearly

200 per cent, and of lumber, timber, and shingles about 300 per cent. There have been established a sawmill with an annual capacity of about 30,000,000 feet of manufactured lumber, and a shingle mill with an annual capacity of about 8,000,000. In addition, cedar and juniper logs to the value of about \$100,000 annually are being taken out on barges for manufacture into shingles at other mills.

The estimated commerce of 1884 and 1900 is shown as follows:

	1894.	1900.
	<i>Tons.</i>	<i>Tons.</i>
Farm products and general merchandise.....	2,039	5,943
Lumber, shingles, and timber	21,250	82,338
Total	23,289	88,281

There are said to be available in the territory tributary to this river upwards of 500,000,000 feet of marketable standing timber, the value of which, on the river bank, is about \$6 per thousand, or \$3,000,000; enough to keep the present mill plant working for over thirty years. Farm lands, hitherto more or less abandoned since the civil war are being energetically worked and extended to the timber land as the latter is stripped and made available. A steady further increase in farm products may, therefore, be expected.

The present commerce of 88,000 tons annually is an increase in tonnage of about fourfold in six years, and the increase in value is probably still greater. The value of this 88,000 tons annually is approximately \$1,000,000. Nearly all of this business is seriously handicapped by lack of water on the bar at the river mouth, the limiting depth of which, in a very narrow channel, is but 5 feet, as shown by accompanying¹ map; and this depth is liable to a decrease of 1 or 2 feet during prevalence of strong westerly winds. The regular steamers and the tugs with barges in tow are frequently delayed outside of the bar, sometimes having to weather heavy northwesterly gales in this exposed place. The steamers and tugs used are necessarily of light draft, and barges, which at neighboring ports can be loaded to their full draft of 8 feet—the limit for passage to Norfolk—must here be loaded light in order to pass over the bar. The locality is at a consequent disadvantage as compared with neighboring ports shipping similar products.

The estimated cost of dredging a channel 9 feet deep and 150 feet wide, across the bar, is as follows:

61,200 cubic yards, scow measurement, at 20 cents.....	\$12, 240
Superintendence and contingencies, 15 per cent.....	1, 836
Total	14, 076

This estimate is based on the assumption that the dredging can be done with Government plant similar to that in use on the Pamlico, Neuse, and neighboring rivers. In all probability this same plant can be utilized at this locality, should an appropriation be made for its improvement. If, however, the work is done by contract, the estimated cost should be increased to \$30,000.

The expenditure of about \$14,000, as above, will directly benefit a commerce of 88,000 tons annually, valued at approximately \$1,000,000.

¹ Not printed.

This expenditure is at the rate of about 16 cents per ton, which probably would be saved to the community in freight rates within a year or two.

For reasons as above given, I am of the opinion that the improvement asked for—a channel 9 feet deep and 150 feet wide through the bar at the river mouth—is justified by the commerce involved, and I respectfully recommend that an appropriation of \$14,000 be made for that purpose, the work to be done by Government plant and hired labor.

The location and extent of the proposed channel to be dredged is shown on map¹ submitted herewith. The length of this channel is 3,400 feet, instead of 1,200 feet as specified in the act of June 6.

Respectfully submitted.

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE.
Baltimore, Md., November 21, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

The character of some of the commerce of this river is now of national importance, and its rapid increase, in my judgment, justifies the fostering of it. A reference, however, to the item of the law authorizing the survey will disclose the fact that the limits of the improvement prescribed have been exceeded in this report. But it is believed that the intention of the law was to relieve the commerce interested by furnishing an available depth of 9 feet. A channel of that depth, "1,200 feet long," as limited by the law, would not be available. Therefore the district engineer was, in my judgment, warranted in reporting on a channel 3,400 feet long.

I concur in the opinion of the district engineer that the improvement is worthy of being undertaken by the General Government.

PETER C. HAINS,
Colonel, Corps of Engineers.
Division Engineer, Southeast Division.

L 19.

EXAMINATION AND SURVEY OF TRENT RIVER, NORTH CAROLINA.

[Printed in House Doc. No. 121, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 3, 1900.

SIR: I have the honor to submit herewith copies of reports dated August 9 and November 17, 1900, by Capt. E. W. Van C. Lucas, Corps of Engineers, upon preliminary examination and survey, respectively,

¹ Not printed.

of Trent River, North Carolina, from the junction of Trent River with Neuse River up to Trenton, with a view to obtaining a depth of 8 feet at mean low water at the city of Newbern and up to the wharves and freight depots of said city; a channel 50 feet wide and 8 feet deep from Newbern through Foys Flats to Pollokville, and a channel 30 feet wide and 4 feet deep at mean low water from Pollokville to Trenton, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

In the preliminary report Captain Lucas states that, in his opinion, concurred in by the division engineer, Col. Peter C. Hains, Corps of Engineers, the river is worthy of improvement by the General Government at Newbern only, and a project is presented for dredging below the Atlantic and North Carolina Railroad Bridge, between the harbor line and the channel, to a depth of 8 feet at dead low water, at a cost of about \$24,000. This improvement is recommended by Captain Lucas, provided a sufficient appropriation is also made for dredging through shoals in the Neuse River below Newbern; and in forwarding the report on survey Colonel Hains states that, for reasons given, the proposed improvement is worthy of being undertaken only when the Neuse River is similarly improved, but not till then.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF TRENT RIVER, NORTH CAROLINA, WITH A VIEW TO OBTAINING A DEPTH OF 8 FEET AT MEAN LOW WATER AT THE CITY OF NEWBERN AND UP TO THE WHARVES AND FREIGHT DEPOTS OF SAID CITY; A CHANNEL 50 FEET WIDE AND 8 FEET DEEP FROM NEWBERN THROUGH FOYS FLATS TO POLLOKSVILLE, AND A CHANNEL 30 FEET WIDE AND 4 FEET DEEP FROM POLLOKSVILLE TO TRENTON.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., August 9, 1900.

GENERAL: In compliance with letter from your office, dated July 3, 1900, I have the honor to submit the following report of preliminary examination of—

Trent River from the junction of Trent River with Neuse River up to Trenton, with a view to obtaining a depth of eight feet at mean low water at the city of Newbern and up to the wharves and freight depots of said city, and a channel fifty feet wide and eight feet deep from Newbern through Foys Flats to Pollokville, and a channel thirty feet wide and four feet deep at mean low water from Pollokville to Trenton.

This proposed improvement consists of three distinct parts: (1) To obtain 8 feet mean low-water depth at Newbern; (2) to obtain 8 feet mean low-water depth and 50-foot channel width between Newbern and Pollokville, and (3) to obtain 4 feet mean low-water depth and 30-foot channel width between Pollokville and Trenton.

The first item, to obtain 8-foot depth at Newbern, is really a proposition to improve an important section of Newbern Harbor. The

commerce affected amounts to about 112,000 tons annually, carried on two lines of steamers running to the North Carolina sounds, and these steamers at times are unable to reach their wharves during extreme low stages of the river. This condition can be remedied at comparatively small expense, and this part of the proposed improvement is, in my opinion, a worthy one. I therefore recommend that the necessary survey be authorized, at a cost not exceeding \$200, to be paid from available balance to the credit of "Improvement of Trent River, North Carolina."

The second item, to obtain a channel 8 feet deep and 50 feet wide from Newbern to Polloksville, includes about 18 miles of the river, on which the present annual commerce is about 40,000 tons, three-fourths of which is timber in rafts, and the remainder, 10,000 or 12,000 tons, is carried on a small steamer making two and sometimes three trips per week. This steamer, and the tug used for rafting, draw less than 5 feet, and experience no trouble in this part of the river, and the proposed improvement is for the benefit of a commerce purely prospective.

The only obstacle preventing 8-foot navigation to Polloksville is one shoal 4 miles above Newbern, about 600 feet long and about 7.5 feet least depth, so that a deepening of 6 inches only for 600 feet in length is contemplated.

The accompanying letter from Mr. C. E. Foy, of Newbern, is the only statement favoring the proposed improvement that I have been able to obtain, and his reasons in support thereof may be summarized as follows:

- (1) A resulting 20-mile extension of Newbern Harbor, giving protected anchorage in fresh water.
- (2) A saving of transfer charges on freight to Polloksville.
- (3) The making available large deposits of marl and shell rock.
- (4) A consequent development of farming and trucking land now idle.
- (5) The making available of large tracts of standing timber.
- (6) Many new industries.

In considering these arguments it should be borne in mind that the present depth (7.5 feet) is about as much as the governing depth out of the North Carolina sounds up to less than a year ago, when the deepening to 10 feet of Dismal Swamp Canal was completed, and if these benefits will follow a deepening of 6 inches, it is singular that no effort has been made under existing conditions, which so nearly approach those requested.

In regard to these arguments I have to state, concerning (1), that Trent River is already available as a harbor for 4 miles above Newbern, with a depth of over 9 feet, but it is not so used above Newbern; concerning (2), (3), and (5), the river has been for years open to Polloksville for barges drawing 6 to 7 feet, of which many have come to Newbern, but none have gone above. The principal lumbermen on Trent River state that they would not send barges up, whatever the depth. Concerning (4), it is not seen how farming interests would be benefited appreciably more than at present, and truck requires fast freighting, and if sent by water through the sounds must be by steamers too long to navigate this river. Concerning (6), it is not definite enough to discuss.

In my opinion this part of the river is not at present worthy of further improvement by the General Government, and I do not recommend a survey.

The third item—to obtain a channel 4 feet deep and 30 feet wide between Polloksville and Trenton—includes about 20 miles of river, on which the present project depth of 3 feet and width of 30 feet exist. Its commerce consists of about 5,000 tons annually and a few timber rafts, the former carried by the small steamer above mentioned. This steamer makes practically uninterrupted trips at all seasons, and is able to handle all the freight offered, and I have been unable to ascertain any good reason for increasing the project depth by 1 foot.

In my opinion, this part of the river is at present unworthy of improvement by the General Government, and I do not recommend a survey.

Recapitulating, this river is, in my opinion, worthy of improvement by the General Government at Newbern only, and a survey of that part is recommended at a cost not exceeding \$200, to be paid from available balance belonging to “improvement of Trent River, North Carolina.”

Very respectfully,

Brig. Gen. JOHN M. WILSON,

Chief of Engineers, U. S. A.

(Through the Division Engineer.)

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 13, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

I concur in the opinion of the district engineer that at this time this river is only worthy of improvement by the Government as far as Newbern.

The proposed survey is recommended for approval.

* * * * *

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 17, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Trent River, North Carolina (full text of item quoted within), made to comply with the requirements of the emergency river and harbor act of June 6, 1900.

It is the opinion of the local and division engineers that the river is worthy of improvement by the General Government at Newbern only.

I recommend that a survey be made and the cost of improvement be estimated in accordance with the within views of the local engineer.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

(Third indorsement.)

WAR DEPARTMENT,
August 18, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

LETTER OF MR. C. E. FOY.

VIRGINIA-CAROLINA CHEMICAL COMPANY,
NORFOLK SALES DEPARTMENT,
Newbern, N. C., August 7, 1900.

"TRENT RIVER, NORTH CAROLINA, IMPROVEMENT."

DEAR SIR: Regarding the improvement of Trent River so as to make it an 8-foot depth to the railroad wharf at Newbern and to Polloksville, in Jones County, then a 4-foot depth from Polloksville to Trenton, the foreign and coastwise trade of this river can be very greatly increased if a sufficient depth—say 8 feet to Polloksville—is made. This stream already has a depth of 10 to 15 feet water to Polloksville, except in one or two short places.

There are many reasons and advantages that this improvement would give to this section of country.

(1) It would give at a very small outlay of money an extension of Newbern Harbor 20 miles, where vessels and other boats could lay in fresh water during the winter months free from storms.

(2) Barges and other boats could load with lumber, cotton, and the other products of the country, and save the cost of transfer charges on the local freight, which in some cases are as much as from Polloksville to Newbern or Newbern to Polloksville as it is from Newbern to Norfolk. For instance, we can bring a cargo of fertilizers from Norfolk to Newbern at 80 cents per ton; there are times we can bring it from Baltimore to Newbern at 80 cents per ton, while we have to pay on these goods 80 cents per ton from Newbern to Polloksville. If these small obstructions were removed in the Trent River we could ship cargoes of fertilizers, kainit, acid phosphate, and other articles of commerce up the Trent River without breaking bulk direct from Norfolk, Baltimore, or Charleston, and these same boats could get return cargoes of lumber and other products of the country, thereby saving to the trade and commerce of the Trent River section a large part of the expense in handling their goods.

(3) There are millions of tons of the finest marl and shell rock lying on the banks of the Trent River, which at present can only be moved in a small way at heavy expense, when if larger boats could navigate the river these items alone would bring to that section a great revenue and business.

(4) The lands tributary to the Trent River are very fine and capable of producing large quantities of corn, cotton, fruit, and vegetables. At this time when the profits in farm products are so small the truck and vegetable business is almost entirely crowded out from that section on account of the additional freight which the farmers are compelled to pay.

(5) There are many millions of feet of standing timber tributary to the Trent River, and it will require many years to remove this timber. If it can be manufactured on the Trent River and shipped direct in large boats to destination, instead of the rehandling and transfer, this would be a great saving both to the owners and manufacturers.

(6) There are many new industries that would be started along the line of the Trent River if a depth of 8 feet of water could be secured in the river from Newbern to Polloksville. A distributing point would be made at Polloksville for all classes of heavy goods used in that section and points above.

I have personally known this country for more than forty years, and the increase in commerce has been far above our expectations since the beginning of the Government improvement on this river about the year 1879. I believe the improvement will be very much greater if we can secure a depth of water that will bring us foreign and coastwise trade.

Yours, very truly,

C. E. Foy.

Mr. S. F. BURBANK,
United States Assistant Engineer, Newbern, N. C.

SURVEY OF TRENT RIVER, NORTH CAROLINA, WITH A VIEW TO OBTAINING A DEPTH OF 8 FEET AT MEAN LOW WATER AT THE CITY OF NEWBERN AND UP TO THE WHARVES AND FREIGHT DEPOTS OF SAID CITY.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., November 17, 1900.

GENERAL: In compliance with instructions contained in letter from your office, dated August 22, 1900, I have the honor to submit the following report on proposed improvement of Trent River, North Carolina:

This survey was authorized under the emergency river and harbor act of June 6, 1900, for that part of the river at Newbern, "with a view to obtaining a depth of eight feet at mean low water at the city of Newbern and up to the wharves and freight depots of said city."

The proposed improvement is for the benefit of the city of Newbern, N. C., one of the two principal ports of Pamlico Sound and tributaries. Newbern is situated at the junction of the Neuse and Trent rivers, on both of which it has available water front, and water transportation to and from both rivers is by way of Neuse River below Newbern. The location of the city, its harbor and approaches, is shown on Coast Survey Chart 410; and dredging is proposed in front of the city wharves on Trent River, as indicated on the accompanying map¹ of the river at Newbern.

The estimated commerce of Newbern in 1899 was 334,141 tons, of which about 250,000 tons was carried to or from Pamlico Sound or beyond. Its estimated value was \$3,500,000 to \$4,000,000, and fully half went to or from the Trent River water front; so that the project under consideration is for the benefit of a commerce estimated at 125,000 tons annually, valued at nearly \$2,000,000.

The accompanying map shows the locality under consideration, the soundings being reduced to dead low-water level, which is a little over 3 feet below ordinary low-water level.

The variation in water level is due entirely to wind, the effect of lunar tides being imperceptible, and the dead low-water stage obtains a few times each year, occasionally for several days at a time, during the prevalence of strong northwesterly winds. At such times the steamers, tugs, and barges engaged in transportation to and from Pamlico Sound and beyond are unable to move to or from the Newbern wharves, and the business of the transportation companies is sometimes, for this reason, brought to a standstill. Hence, the demand for deepening the water along these wharves. The delays due to low water are vexatious and embarrassing to all vessels involved, but particularly so to the steamers of the Norfolk and Southern Railroad Company, which, in addition to a large part of the freight, carried about ten thousand passengers in 1899, and have to run on a somewhat rigid schedule in order to make connections with the Norfolk and Southern Railroad at Elizabeth City.

The estimated cost of the desired dredging is as follows:

For dredging a cut 300 feet wide and 8 feet deep at dead low water, as shown on accompanying map—	
60,000 cubic yards, scow measurement, at 20 cents.....	\$12,000
Superintendence and contingencies, 15 per cent.....	1,800
Total	13,800

¹ Not printed.

For dredging to 8 feet depth at dead low water between the harbor line and channel (includes preceding estimate)—

104,000 cubic yards, scow measurement, at 20 cents.....	\$20,800
Superintendence and contingencies, 15 per cent.....	3,120

Total	23,920
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This last dredging is recommended, as, if made, it will clear the river of shoals between the harbor line and the deep-water channel and leave the Trent River part of Newbern Harbor free from obstructions to navigation at all stages of water level. Its cost of about \$24,000 will benefit a commerce worth nearly \$2,000,000 annually; and, considered alone, it is, in my opinion, for the reasons above stated, a worthy improvement.

As previously stated, all out-bound traffic from Trent River must go down Neuse River, in which are two or three shoals, and the improvement of Trent River at Newbern will be of no benefit to navigation unless the channel across these Neuse River shoals is deepened to the same extent. The deepening of Neuse River at and below Newbern was made the subject of a report, dated February 19, 1897, by Lieut. Col. D. P. Heap, Corps of Engineers, then in charge of this district. This report was printed in House Doc. No. 317, Fifty-fourth Congress, second session, and appears also on page 1427, Annual Report of the Chief of Engineers for 1897. The estimate submitted amounted to \$59,081.25, and covered the cost of dredging along the Neuse River water front at Newbern to the same depth as now contemplated for the Trent River water front, and also dredging through two shoals in Neuse River below the city. These two shoals are, as above stated, obstacles to the navigation of Trent River. Colonel Heap considered this improvement, at a cost of \$59,000, as justified, for a commerce then estimated at 175,000 tons annually, his estimate of cost being based on a cost per cubic yard of 50 cents, a fair price if done by contract; but since then a small United States dredge has been equipped and is available for this work, with which dredging can be done at a cost not exceeding 20 cents per cubic yard, at which figure the cost of the work recommended by Colonel Heap would be reduced to about \$24,000 for the whole, and to about \$6,500 for that part below Newbern.

It is therefore recommended that an appropriation of \$24,000 be made for dredging Trent River at Newbern to 8 feet depth at dead low water between the harbor line and channel, as shown on accompanying map, provided a sufficient appropriation is also made for dredging through shoals in Neuse River below Newbern which now affect Trent River navigation.

Respectfully submitted.

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 21, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

It is evident that while the commerce of Newbern and the Trent

River is of sufficient importance to justify the improvement of the river for an 8-foot navigation, it can not be utilized until an outlet is made by dredging through shoals in the Neuse River, an action not contemplated in the item of the law under consideration.

In my opinion the improvement of the Trent River to the extent of about \$24,000, as indicated in the report of the district engineer, is worthy of being undertaken by the General Government only when the Neuse River is similarly improved, but not till then.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

L 20.

EXAMINATION AND SURVEY OF WILMINGTON HARBOR AND CAPE
 FEAR RIVER, NORTH CAROLINA.

[Printed in House Doc. No. 180, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
 UNITED STATES ARMY,
 Washington, December 6, 1900.

SIR: I have the honor to submit herewith copies of reports dated August 9, 1900, and November 24, 1900, by Capt. E. W. Van C. Lucas, Corps of Engineers, upon preliminary examination and sur-

vey, respectively, authorized by the emergency river and harbor act approved June 6, 1900, as follows:

Wilmington Harbor: With a view to providing a sufficient width and depth to permit vessels now using said harbor to turn or swing around therein, Cape Fear River, with a view to obtaining a navigable channel from Wilmington to Fayetteville of four, six, or eight feet at mean low water.

This item of the act relates to two distinct propositions, which it will be necessary to treat separately.

Wilmington Harbor has been under improvement by the United States for many years, and owing to its commercial importance is regarded by both the local officer and the division engineer, Col. Peter C. Hains, Corps of Engineers, as worthy of further improvement. The plan proposed by Captain Lucas for furnishing a sufficient width and depth to permit vessels to swing and turn in the harbor provides for dredging an anchorage basin in the lower part of the harbor at an estimated cost of \$291,500. In the opinion of Colonel Hains an anchorage basin of the kind called for by the act is unnecessary, and therefore is not a work worthy of being undertaken by the General Government. In lieu of such an anchorage basin, he suggests the plan adopted at Savannah, where the conditions are similar to those at Wilmington, which is to construct mooring dolphins, to which vessels may be secured without the necessity of anchoring. A suitable number of dolphins established alongside of the ship channel, but not in it, together with such dredging as may be necessary, would cost, he estimates, \$30,000.

Cape Fear River from Wilmington to Fayetteville is at present being improved under a project which provides for removing obstructions and obtaining a continuous channel by means of jettying and dredging. By this method Captain Lucas thinks it will not be possible to secure a certain depth at all seasons of 4 feet, which is the least depth contemplated by the act of June 6, 1900. By the construction of locks and dams the depth of 4 feet could be obtained with certainty. The cost of such an improvement is estimated at \$1,320,000, and this work is recommended by the local officer. By increasing the lift of the locks and doing some dredging the maximum depth of 8 feet could be obtained, and the increased cost is estimated at not to exceed \$30,000. In view of this small difference in the estimated cost for obtaining channels for 4-foot and 8-foot navigation, no estimate is submitted for the medium depth of 6 feet named by the act.

Colonel Hains, the division engineer, invites attention to the fact that in these estimates no provision is made for maintenance of the improvement when completed, and states that in view of the small additional cost of an 8-foot over a 4-foot navigation the former depth is to be preferred if the plan for slack-water improvement be adopted. He concludes his indorsement of November 30, 1900, with the statement that "while I am of the opinion that the Cape Fear River is worthy of improvement, I can not subscribe to the opinion that it is worthy of improvement at the present time to the extent herein indicated."

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF WILMINGTON HARBOR, NORTH CAROLINA, WITH A VIEW TO PROVIDING A SUFFICIENT WIDTH AND DEPTH TO PERMIT VESSELS NOW USING SAID HARBOR TO TURN OR SWING AROUND THEREIN, AND OF CAPE FEAR RIVER WITH A VIEW TO OBTAINING A NAVIGABLE CHANNEL FROM WILMINGTON TO FAYETTEVILLE OF 4, 6, OR 8 FEET AT MEAN LOW WATER.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., August 9, 1900.

GENERAL: In compliance with instructions contained in letter from your office dated July 3, 1900, I have the honor to submit the following preliminary report on—

Wilmington Harbor: With a view to providing a sufficient width and depth to permit vessels now using said harbor to turn or swing around therein; Cape Fear River, with a view to obtaining a navigable channel from Wilmington to Fayetteville of four, six, or eight feet at mean low water.

This proposed improvement includes two distinct items: First, an anchorage basin at Wilmington, and second, the deepening of Cape Fear River channel between Wilmington and Fayetteville to 4, 6, or 8 feet.

Concerning (1) the proposed anchorage basin at Wilmington. The river at Wilmington has a maximum width, for 20 feet or greater depth, of about 600 feet, which is not enough to enable large steamers to swing at anchor. It is proposed to dredge a suitable basin in the lower part of the harbor, where the present width of the river is 1,200 to 1,500 feet.

Wilmington is the principal seaport of the State, and in 1899 its river and sea commerce amounted to more than 600,000 tons, valued at over \$33,000,000. Its present need of an anchorage basin is apparent, and this need must become more and more pressing with the increasing importance of the principal and only important seaport of a State the natural resources of which are yet comparatively undeveloped, although just entering a stage of active development.

No survey is necessary for the preparation of estimates, the data for which can be obtained from records and maps in the office of the "Improvement of Cape Fear River at and below Wilmington, N. C.;" consequently no allotment will be needed for this part.

In my opinion, the proposed improvement is a worthy one and I recommend that I be authorized to submit the necessary plans and estimates.

Concerning (2) the proposed deepening of Cape Fear River channel between Wilmington and Fayetteville to 4, 6, or 8 feet: This proposed improvement particularly affects the town of Fayetteville, 115 miles by river from Wilmington, and involves the improvement of about 70 miles of river on which the governing ordinary low-water depth is now about 2 feet, and during extreme low-water stages only 6 inches. Such an improvement will also be of ultimate great benefit to the intervening country, which, however, is now undeveloped.

Fayetteville is a flourishing town at the head of navigation, was formerly a very important distributing point for a large section of country, and is now of rapidly growing importance as a manufacturing center. The extent of its present interests is indicated in the accompanying letter from its chamber of commerce. Particular attention is invited to the statement therein as to "the certain prospect of electric power at \$15 per horsepower per annum." This statement I know to be founded on fact, and I also know that it can be very

greatly extended by the utilization of available water power of the Cape Fear River and its tributaries above Fayetteville. There is no apparent reason why electric power can not be applied there with equal or greater success than that achieved at the great mills at Pelzer, S. C.

The present annual commerce on the river is about 50,000 tons, even on a limiting draft of 2 feet or less, and manufacturers at Fayetteville assure me that they would gladly take much greater advantage of river transportation if they could depend on certain trips by river steamers insuring connection with coastwise steamers from Wilmington. They inform me that such means of transportation, when connections at Wilmington can be made, is now cheaper and quicker to New York than rail transportation.

For the bulk of their freighting they are now dependent on the railroads entering Fayetteville, all of which are controlled by one corporation, thus practically destroying competition.

The present project contemplates obtaining "a continuous channel (depth not stated) to Fayetteville," and the estimated amount needed to complete it is \$135,750. If a new project is adopted, the above amount will be included in its estimated cost.

In my opinion the river is worthy of further improvement by the General Government, and I recommend that authority be granted to make the necessary survey, at an estimated cost of \$2,500, of which amount \$1,000 is available from the balance to the credit of "improvement of Cape Fear River above Wilmington," and the remainder should be allotted from funds appropriated by emergency river and harbor act of June 6, 1900.

Very respectfully,

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., August 13, 1900.

Respectfully submitted to the Chief of Engineers, U. S. A.

Wilmington Harbor and the Cape Fear River from that harbor to Fayetteville are both worthy of improvement by the Government, or, rather, continued improvement, as both have received such attention from the United States.

The extent to which the Upper Cape Fear River should be improved can be best determined after a survey is made.

The views of the district engineer are recommended for approval.

* * * * *

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 17, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Wilmington Harbor, North Carolina, and of Cape Fear River from Wilmington, N. C., to Fayetteville (full text of item quoted within), made to comply with the requirements of the emergency river and harbor act of June 6, 1900.

The proposed anchorage basin at the harbor of Wilmington and the improvement of the Cape Fear River from Wilmington to Fayetteville are, in the opinion of the local officer and of the division engineer, considered as work worthy of being undertaken by the General Government.

No survey is required for the preparation of plan and estimate of cost of the proposed anchorage basin, the necessary data being already available, but a survey will be necessary to prepare plan and estimate of cost of improvement between Wilmington and Fayetteville. I recommend that the local officer be directed to submit the necessary plan and estimate for obtaining the proposed anchorage basin, and also that a survey of the river between Wilmington and Fayetteville, including preparation of plan and estimate, be authorized.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT,
August 18, 1900.

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

LETTER OF THE FAYETTEVILLE (N. C.) CHAMBER OF COMMERCE.

CHAMBER OF COMMERCE,
Fayetteville, N. C., August 8, 1900.

DEAR SIR: The Fayetteville Chamber of Commerce desires to call your attention to the great necessity which exists for the improvement of the navigation of the Cape Fear River from Wilmington, N. C., to Fayetteville, N. C., the head of its navigable waters. Fayetteville, N. C., for almost a century enjoyed the advantage and distinction of being, commercially, the most important inland town in the State. This condition was brought about by its position at the head of the Cape Fear River, upon whose splendid waters all the heavy shipments of salts, iron, molasses, coffee, and merchandise generally found their way through Fayetteville all over the western counties of the State, reaching into East Tennessee and into the States to the north and south of us. The building of railroads in the last quarter of a century and more deflected these shipments elsewhere, and the Cape Fear River did not receive that attention which its importance to the people of a large section of North Carolina would seem to have warranted. Latterly Fayetteville, N. C., has attracted the attention of several manufacturing capitalists, and is beginning to be regarded as a promising manufacturing center, as is shown by the following industries, the most of which have been erected very recently here and in vicinity.

Hope Mills, 15,000 spindles, 750 looms; Holt Morgan Mills, 10,000 spindles, 500 looms; Holt Williamson Mills, 5,200 spindles; Fayetteville Cotton Mills, 3,120 spindles; Bluff Mills, 200 looms; Murchison Mills, 3,000 spindles, 100 looms; Cumber-

land Mills, 3,000 spindles; Ashely-Baily Silk Mills, 100 looms; La Fayette Knitting Mills; Lacy Manufacturing Company Furniture Mills; Fayetteville Cotton Oil and Fertilizer Company, 40 tons daily; Carolina Machine Shops; Ward's Foundry; Emmitt's Roller Corn Mill; Williams Furniture Factory; McNeill's Roller Rice and Grist Mill; Clark's Machine Shop; Carolina Roller and Grist Mill; Watson Planing Machine Mill; Tobacco warehouse; Fayetteville Wooden Ware Company; Tolar Hart Holt Mills, 15,000 spindles; E. A. Poe's Brick Yard Works; several saw-mills and other industries.

All these produce vast amount of freight, and many of these works already use the river in their transportation and in this way enjoy a large profit in saving on freights alone. The present tonnage of river freights is 50,000 tons, but if water could be assured the year round, even with the present river transportation facilities and the present business, there would be no trouble in increasing the tonnage 100 or even 150 per cent. But we have in the near future the certain prospects of electric power at \$15 per horse per annum. This will in a few years (with our other advantage) bring a great many new and important industries to our city. We know of three very large ones that will come here certainly as soon as the electric power reaches us. This is to be produced by the waters of the Cape Fear River at a point some miles above us, and the fact of its coming here seems to be well assured. It is almost impossible for us to estimate the amount of freight in tons that would seek the river transportation if a regular depth of water was assured. But from the great advantage in freight rates that would favor water transportation we know that several more steamboats would go on at once, and that soon the Cape Fear River would regain its old-time importance, blessing a large section of the State by its beneficent freight rates.

Fayetteville, N. C., is a port of entry, and the Cape Fear River is under the control of the Government. There is no stream in North Carolina that will bring so much in return for every dollar expended upon its improvement by the Government.

Yours, truly,

Capt. E. W. VAN C. LUCAS,
United States Engineer.

F. R. ROSE,
Secretary Chamber of Commerce.

PLAN AND ESTIMATE OF COST OF PROVIDING A SUFFICIENT WIDTH AND DEPTH IN WILMINGTON HARBOR, NORTH CAROLINA, TO PERMIT VESSELS NOW USING SAID HARBOR TO TURN OR SWING AROUND THEREIN, AND SURVEY OF CAPE FEAR RIVER WITH A VIEW TO OBTAINING A NAVIGABLE CHANNEL FROM WILMINGTON TO FAYETTEVILLE OF 4, 6, OR 8 FEET AT MEAN LOW WATER.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., November 24, 1900.

GENERAL: In compliance with letter from your office dated August 25, 1900, I have the honor to submit the following report on proposed anchorage basin at Wilmington, N. C., and proposed improvement of Cape Fear River between Wilmington and Fayetteville, N. C. This survey was authorized under the emergency river and harbor act of June 6, 1900, as follows:

Wilmington Harbor: With a view to providing a sufficient width and depth to permit vessels now using said harbor to turn or swing around therein: Cape Fear River, with a view to obtaining a navigable channel from Wilmington to Fayetteville of four, six, or eight feet at mean low water.

The above authority includes two distinct items, which will be considered separately.

(1) WILMINGTON HARBOR, ANCHORAGE BASIN.

Wilmington, the principal seaport of North Carolina, is situated on the Cape Fear River about 30 miles from its mouth, and has access to the sea by a channel with least low-water depth of 20 feet and least

high-water depth of 22 feet. The accompanying map shows the harbor and the city water front. The city had an annual commerce in 1899 estimated at over 600,000 tons, valued at over \$33,000,000; and for the current year it is claimed that there will be a considerable increase in tonnage, and that the total valuation will amount to \$40,000,000. The greater part of this commerce is carried on steamers and sailing vessels drawing from 15 to 21 feet, many of them 300 to 350 feet long.

Before proceeding to their wharves for discharging and loading, these large vessels are generally delayed waiting for orders, during which time they are compelled to anchor.

The present anchorage facilities for 20 feet or greater depth are of the poorest, and limited to the deep-water channel opposite the center of the city, with a greatest width of about 600 feet, which gradually narrows to about 150 feet width in the dredged channel below. At its best, a width of 600 feet does not afford swinging room for a vessel 300 feet long, and the widest channel available is in the busiest part of the harbor, and vessels anchoring there become an impediment to its business. If anchored in the narrower and shoaler channel below, they are likely to ground or to foul their anchors. The harbor master states that during the last year 25 to 30 vessels have gone aground while at anchor, some of which have resulted in serious injury, with consequent damage claims.

It is therefore evident that this port has no adequate anchorage facilities, and as a consequence it is becoming more and more difficult to charter large vessels for this port, which places it at a distinct disadvantage. No large vessel can now anchor in this harbor without danger of grounding or without interfering with business, and possible accident.

Estimates have been prepared for an anchorage basin opposite the lower end of the city, with a width of 1,200 feet and a length of 3,000 feet. These dimensions, giving an area of over 80 acres, will afford room for an ample channel through the center and anchorage on each side of such center channel for four large steamers, moored fore and aft. The estimated depth is 28 feet at low water, which will give sufficient room under the keels of vessels to avoid danger from fouling anchors. The harbor master informs me that such an anchorage basin would be satisfactory and afford ample accommodations for the present needs of the port. As these needs increase the dredged basin can be extended downstream for 6,000 to 8,000 feet, with width increasing up to 2,000 feet. Estimates are also submitted for dredging to 20 feet depth the approaches to the anchorage basin from both directions, so as to make it easily accessible. These estimates are as follows:

For anchorage basin, as shown, 2,052,000 cubic yards, at 10 cents.....	\$205,200
Up-river approach, 412,000 cubic yards, at 10 cents.....	41,200
Down-river approach, 186,000 cubic yards, at 10 cents.....	18,600
Superintendence and contingencies, 10 per cent.....	26,500
Total	291,500

Such an anchorage basin, if approved, will involve an unimportant alteration of the lower end of the approved harbor line on the city side, which at present is a straight line from A to C on accompanying map, but which, if above project is approved, should be changed to the broken line A B C. There is no likelihood of objection to such a change in harbor line, as it will interfere with no existing structures, and, on the contrary, will give deeper water at the wharf heads.

¹ Not reprinted; printed in House Doc. No. 180, Fifty-sixth Congress, second session.

Such an anchorage basin, at a cost of \$291,500, will benefit a commerce now estimated at \$33,000,000 annually, with every prospect of steady increase, and, for the reasons above stated, is, in my opinion, a worthy improvement, and I recommend that it be undertaken by the United States.

Attention is respectfully invited to the accompanying letters from the Chamber of Commerce, Produce Exchange, and Merchants' Association, all of Wilmington, and from Alexander Sprunt & Son, the largest individual shippers in the city.

(2) IMPROVING CAPE FEAR RIVER BETWEEN WILMINGTON AND FAYETTEVILLE.

The object of this improvement is to obtain all the year round depth of not less than 4 feet, which will involve the improvement of about 70 miles of river on which the present governing depths are 2 feet at ordinary low water and 9 inches at extreme low water. Such low-water depths now result in a practical suspension of navigation during three or four months annually, with the result that the stream is useless for purposes of navigation during a third of the year, and much business which would go to it if certain navigation were assured is now always shipped by rail and at a higher rate.

The estimated present commerce is about 115,000 tons annually, valued at \$1,150,000, and with navigation all the year round this present business would probably at once increase at least 50 per cent, to over 170,000 tons, valued at about \$1,700,000. With certain navigation throughout the year, much of the product of about forty mills now operating at and near Fayetteville would be shipped by river to Wilmington, and thence by steamer to the North, instead of, as now, by rail to Norfolk and thence by steamer to the North. This Fayetteville mill product has an estimated value of \$5,800,000, of which three-fourths, valued at \$4,350,000, could be shipped by river. This makes a total of about \$6,000,000 worth of annual present shipments which would probably utilize the river if certain navigation were established.

As to probable development resulting from the improved navigation, it is claimed in Fayetteville that twelve or fifteen mill enterprises, some with capital already subscribed, are only waiting assurance of certain river navigation to begin the construction of buildings and plant at that city.

There is also a possibility, and perhaps a probability, of the improvement of the river resulting in the reestablishment of Fayetteville as a distributing point for a large section of country. This point is brought out and explained in the accompanying letter from the Fayetteville citizens' committee, their claim being that Fayetteville would, under such circumstances, become such distributing point for a section of country the business of which is estimated in their letter at 6,000,000 tons annually, valued at \$165,000,000.

With certain navigation there would be a probable development of the Cape Fear River Valley, much of which is good farming land. Under present conditions the success of a year's crop depends entirely on the use of the river for transportation to market. During low-water stages the farmers have the alternative of a long, costly haul, or the loss of their crop, if perishable. This section of the country is also interested in the proposed improvement because it will afford much better mail and passenger carrying facilities than now exist.

The wholesale merchants of Wilmington are much interested in the proposed improvement because it means to them a chance of extending their business to Fayetteville and vicinity, which they can not now get because unable to compete with merchants of Richmond and Norfolk, Va., on account of existing rail rates, although Fayetteville is only 83 miles by rail from Wilmington, while it is 211 miles by rail from Richmond and 204 miles from Norfolk.

The interest of Fayetteville is much greater than that of Wilmington, because, although at the head of navigation, its water route to the North can not now compete with the rail routes. North-bound shipments are now usually sent by rail to Norfolk, and thence by water north. All railroads now entering Fayetteville belong to one system, and there is practically no competition. The accompanying letter from the citizens of Fayetteville states the case in a concise and comprehensive form, and shows a probable immediate business affecting Fayetteville of approximately \$5,500,000 annually. Reference has already been made to the possible much greater interest affected if the improvement of the waterway resulted in the establishment of Fayetteville as a distributing point.

Estimates are called for to obtain a depth of 4 feet, 6 feet, or 8 feet at all seasons. The least depth mentioned, 4 feet, can, in my opinion, be obtained with certainty only by a system of locks and dams, as the low-water discharge at Fayetteville is about 212 cubic feet per second, and the fall in the 70 miles below Fayetteville about 20 feet.

The river has been under improvement about twenty years, under a project to clear the river to Fayetteville and obtain a continuous channel—depth not stated—by jettying and dredging, at a cost estimated, in 1893, at \$275,000, of which about half has been spent. The appropriations have been spread over so many years, and in such small amounts, that the improvement thus far attained is local in character, and the present governing depth between Wilmington and Fayetteville is little, if any, better than it was twenty years ago. With an expenditure of \$135,000, in addition to as much already spent, it is believed that the low-water depth can be increased about 1 foot, making the governing depth 21 inches, instead of about 9 inches, as at present. I do not believe it possible to obtain a navigable channel of 4 feet certain depth at all seasons by jettying and dredging.

The minimum depth proposed, 4 feet, can be obtained with certainty by the construction of three locks with movable dams, the locations of which are approximately shown in the accompanying profile sheet of the Cape Fear River; such locks to have a lift of 8 feet. By making the lift 9 feet, instead of 8 feet, and doing a little dredging, the maximum proposed depth, 8 feet, could be obtained. The difference in cost of 4 feet and 8 feet navigation would probably not exceed \$30,000— a little over 2 per cent of the cost of obtaining 4 feet navigation. This difference between costs for 4 feet and 8 feet navigation is so small that it is not deemed necessary to estimate the cost of the intermediate depth of 6 feet.

The form of lock and dam proposed is similar to those used in Kanawha River, and consists of a lock of 8 feet lift, with a chamber 150 feet long and 28 feet wide, and a movable dam about 170 feet long. Such a lock will accommodate any boat capable of navigating the river. Movable dams are deemed necessary because the river is subject to freshets ranging from 40 to 60 feet at Fayetteville to 20 to 30 feet at the lowest proposed lock.

The estimate is as follows:

Three locks, as above described, with movable dams, \$400,000 each	\$1,200,000
Superintendence and contingencies, 10 per cent	120,000
Total	1,320,000

This estimate may appear excessive, but it should be borne in mind that there is no solid rock for foundations, and the estimates are based on bottom of foundations at about 28 feet below low-water surface. In addition, the stream has caving banks, necessitating bank protection for an unusually long distance below each dam, to protect from scour.

This proposed expenditure of \$1,320,000 is for the benefit of an actual present commerce valued at about \$6,000,000 annually, on which, according to the Fayetteville citizens' letter, there would be a resulting saving in rates of about \$70,000 annually, which is over 5 per cent of the estimated cost. On this basis, and for the reasons outlined above and elaborated in the accompanying letters from the citizens' committee of Fayetteville, and the chamber of commerce, produce exchange, and Merchants' Association of Wilmington, I consider the improvement a worthy one and recommend that it be undertaken by the United States.

There are forwarded herewith, under separate cover, a map of Wilmington Harbor, one sheet¹ of profiles of Cape Fear River between Wilmington and Fayetteville, and two sheets¹ of cross sections of river bed and valley at proposed lock and dam sites.

Respectfully submitted.

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 30, 1900.

Respectfully submitted to the Chief of Engineers, U. S. A.

There is a lack of room for large vessels to anchor in front of Wilmington, as is the case in many other places of equal commercial importance, but the construction of an anchoring basin 28 feet deep is an expensive method of meeting the difficulty. The plan adopted in the Savannah River, where the conditions are similar, would seem to meet the case here in a much less expensive way. The plan adopted there is to construct mooring dolphins to which vessels may tie up without the necessity of anchoring. A suitable number of dolphins established alongside of the ship channel, but not in it, together with such dredging as may be necessary, would, it is believed, not cost more than \$30,000, one-tenth the cost of an anchoring basin, and be equally satisfactory to navigation.

The act under which this survey is made calls for a report on the question of "providing a sufficient width and depth to permit vessels now using said harbor to turn or swing around therein." I am of the opinion that an anchorage basin of that kind is unnecessary, and therefore it is not a work worthy to be undertaken by the General Government.

In respect to the project of 4, 6, or 8 feet depth at mean low tide from Wilmington to Fayetteville, the district engineer submits a plan for 8 feet by means of locks and movable dams, at an estimated cost of \$1,350,000. Nothing, however, is provided for maintenance or operation.

It is to be remembered that with a slack-water navigation made by locks and movable dams there is an annual cost for operating, as well as maintenance. Skilled employees to operate the locks, as well as to lower and raise the dams, are required, and dredging and snagging will still be necessary.

The amount appropriated for this river in the past sixteen years has only averaged about \$8,000 per annum. This is not one-third enough to operate and maintain a slack-water navigation. If, therefore, locks and dams had been in existence during this period, the navigability of the channel could not have been maintained on the sums appropriated. The heavy freshets to which this stream is subjected, rising as it does as much as 50 to 60 feet at Fayetteville, brings down great quantities of sediment and great numbers of logs and trees. These logs and trees must be removed and some dredging done annually whether the improvement be by locks and dams or otherwise. In my judgment it would require an annual expenditure of about \$30,000 to operate and maintain this improvement.

That the prospective business may reach the value of \$165,000,000 annually, as estimated, if the river be improved as recommended, I do not believe. Moreover, much of the prospective business would not be in the nature of an increase, but merely a diversion to Fayetteville and Wilmington of business already existing at other points.

The improvement of this upper river by means of locks and movable dams is an expensive one, and after it be completed, if it is to be efficiently maintained, much larger appropriations must be made annually than has formerly been the case. The cost of an 8-foot navigation is so little in excess of the cost of a 4-foot navigation that the 8-foot depth is by all means the one to be preferred if the plan of slack-water navigation be adopted.

While I am of the opinion that the Cape Fear River is worthy of improvement, I can not subscribe to the opinion that it is worthy of improvement, at the present time, to the extent herein indicated.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

LETTER OF A COMMITTEE OF CITIZENS OF FAYETTEVILLE, N. C.

FAYETTEVILLE, N. C., November 21, 1900.

SIR: The undersigned, the committee appointed at the citizens' meeting held on the occasion of your visit on Thursday last, have taken up the subjects of inquiry suggested by you, and have pleasure in reporting as follows:

THE PRESENT RIVER TRAFFIC.

The tonnage of the traffic by the steamboats between this city and Wilmington, as reported by the United States engineer office at Wilmington for the year ending December 31, 1899, was, in round numbers, 115,000. We are informed that its value would average \$10 per ton, which would give a total value of \$1,150,000.

EXISTING LOCAL RAILWAY TRAFFIC WHICH WOULD SEEK THE RIVER IF IMPROVED.

In reply to printed forms issued to our merchants, traders, and manufacturers, made out, when necessary, under supervision, we find that there have been received at and shipped from Fayetteville by rail during the past twelve months 112,295 tons of merchandise of all kinds, valued at \$5,812,614. It is estimated that at least three-fourths of this would at once be diverted to the river for transportation if the proposed improvement were made and the speedy and regular dispatch of freights which it would make possible were established.

TRAFFIC FROM A DISTANCE WHICH WOULD BE DIVERTED TO THE RIVER IF FAYETTEVILLE WERE MADE A "BASING POINT."

We are informed that as soon as the proposed improvement in navigation and the dispatch of freights is effected Fayetteville would be made what the traffic managers call a basing point for freight rates. The effect of this, we are informed, will be to cause all railways which run within the territory thus tributary to Fayetteville to make rates from Fayetteville. By the term "the territory thus tributary to Fayetteville" we mean all the country which is nearer to Fayetteville than to any other basing point, the railway commission laws requiring the rates therein to be proportionately less than to such other basing points.

We inclose a map * * * which will show the territory thus delimited as tributary to Fayetteville. The basing points nearest to Fayetteville are Richmond and Norfolk, Va., on the north, and Charleston, S. C., on the south. We have drawn lines at right angles across air lines between Fayetteville and the three cities named, respectively, and at points midway between Fayetteville and them. Line A is the dividing line between Richmond and Fayetteville; line B, the dividing line between Norfolk and Fayetteville and line C that between Charleston and Fayetteville. It will be seen that, while the northeast section of North Carolina falls within the territory allotted to Richmond and Norfolk, a considerable portion of southwest Virginia and a considerable portion of northeast South Carolina, each larger than the first mentioned, fall within the territory of Fayetteville. As the improvements referred to would also cause Wilmington to be made a basing point, the map would be changed thereby to a comparatively small extent, the effect of the change being to add more to the joint territory of Wilmington and Fayetteville.

We also inclose a copy of a United States Government report on the Manchester Ship Canal * * * in which is described (pp. 5-9) the manner employed in Great Britain for "proving" a commercial reason for the granting of a charter by Parliament for such an undertaking. We shall, in this case, employ the same method, in a general way, because such matters in the older countries have necessarily reached a more exact standard. An important consideration in our favor in relying upon such a method is the fact that the railway commission laws in this country now require connecting lines to transport freight delivered to them, whether a tariff of through rates has been established or not, and, as before mentioned, at rates proportioned to the "length of haul."

Without entering upon a consideration of how far westward beyond the borders of North Carolina the traffic influence of the proposed improvements would extend, we ask attention to the significant coincidence that the territory now delimited on our map is almost the same as that which was tributary to Fayetteville in the last of the eighteenth century, in the first part of the present century, and up to the railroad era. The fact that Canova's statue of Washington was brought from Italy to Wilmington, was thence landed at Fayetteville, and finally hauled overland to Raleigh in the latter period is merely an illustration of the general conditions of transportation at that time.

The proposed improvement, therefore, would not establish a novel condition, but would restore the normal relation of the Cape Fear to a vast territory, which the overworking of the railroad idea and the effect of deforestation upon the water courses have disturbed; or we may state the case this way—that it would be the reestablishment of normal conditions by a development of the problem of transportation, which conditions had been disturbed by a cruder stage of the movement.

Within the limitations of our map, as thus restricted, it will be seen that there is a population equal to that of the State of North Carolina (some 1,900,000). The population which by a liberal estimate might be considered as involved, in one way or another, in the production of the existing river traffic and the existing railway traffic divertible to the river, in and out of Fayetteville, may be said to

¹ Not printed.

include that of Cumberland County, in which Fayetteville lies (30,000), and one-fourth of that of the contiguous counties of Sampson (7,000), Bladen (5,000), Robeson (9,000), Moore (6,000), and Harnett (4,000)—a total of 61,000. The territory, then, on the map, this side of the Blue Ridge, contains a population thirty times as great as the population at present tributary to Fayetteville.

We therefore have this proposition:

	Tons.	Value.
Existing river traffic.....	115,000	\$1,150,000
Three-fourths (the divertible portion) of existing railway traffic in and out of Fayetteville—three-fourths of 112,295 tons and three-fourths of \$5,812,614.....	84,221	4,359,460
In round numbers.....	200,000	5,500,000
Thirty times these figures would give the tonnage and value of traffic which, other things being equal, would find a cheaper route to and from the great markets by way of the Cape Fear River if improved as suggested—that is, 30 by 200,000 tons and 30 by \$5,500,000.....	6,000,000	165,000,000

In this connection it is worth noting that Mr. Walter L. Holt, one of the chief owners of cotton mills in this county and in Alamance County, 100 miles distant, finds that he gets his oils, dyes, and machinery and ships his finished products by river from his Fayetteville (Cumberland) mills for an average of but half the freight rate which he is obliged to pay by rail to and from his Alamance mills.

THE RAILWAY COMMISSION'S FIGURES.

We further inclose a letter from the North Carolina corporation (railway) commission. * * * from which it will be seen that the actual freight-traffic movement for the past year over the roads converging at Fayetteville, and within the territory indicated on our map, amounted to 1,497,976 tons, or one-fourth of the tonnage (6,000,000) which we have estimated by the per capita method for the whole territory east of the mountains. It will be observed also that the commission's letter expresses the hope that "the Government will see the importance of this station (Fayetteville), which, by reason of its situation, should again become the distributing point for the central and western North Carolina territory."

Attention may also be called to the fact that Fayetteville, at the head of navigation, 100 miles inland, is the only point on the Atlantic Coast Line between Richmond and Charleston (the present basing points) which is situated on navigable water.

How far the inertia of settled routes of trade may act in restraint of the possibilities indicated above is, of course, a matter of conjecture.

THE COMMERCIAL CASE.

We assume that while the Government undertakes works of the kind now proposed for the public benefit, and without expectation of a direct return for its outlay, it is nevertheless influenced by the same considerations which influence private capitalists. That is to say, if the cost of the proposed improvement should be \$1,000,000, it would be a sound commercial undertaking, commending itself to the Government from this point of view, if the additional traffic secured by reason of the outlay, or the resultant economies of transportation on existing traffic, should yield 5 per cent on that amount. Five per cent on \$1,000,000 is \$50,000.

It is apparent that the economies of transportation which such an improvement would render possible—twelve months' running of the boats instead of nine months, the cheaper proportionate handling of larger loads, etc.—would leave a margin for tolls for the use of the improved waterway, if the work were done by a private corporation, far in excess of the reasonable rate of 5 per cent on \$1,000,000. An average of 25 cents a ton on the class of freight (115,000 tons) now carried by the river and 50 cents a ton on the class of freight (84,221 tons) now carried by the railways in and out of Fayetteville, but divertible to the river, would produce a revenue of \$70,860, or over 7 per cent, on the existing Fayetteville traffic alone. A toll of 10 cents a ton would more than pay for the whole investment of \$1,000,000 in two years if all the traffic of the tributary country were diverted this way. Such speculations as to what might be done if the river were the property of private capitalists instead of that of the Government are useful as

indicating how very far within the margin of commercial safety the Government would be acting if it should make such an expenditure.

We desire, in conclusion, to heartily reiterate for ourselves the expression of thanks which the meeting that appointed us unanimously voted to you, sir, for the interest which you have taken in this great work.

We remain, with high esteem, yours, obediently,

W. S. COOK,
Mayor of Fayetteville and Chairman of the Citizens' Meeting.

E. J. HALE.
W. L. HOLT.
F. R. ROSE.
R. L. WILLIAMS
W. M. MORGAN
A. H. SLOCOMB.
H. C. BASH.
J. A. KING.

Capt. E. W. VAN C. LUCAS,
Corps of Engineers, U. S. A.

LETTER OF THE NORTH CAROLINA CORPORATION COMMISSION.

DEPARTMENT OF THE NORTH CAROLINA CORPORATION COMMISSION,
Raleigh, November 20, 1900.

DEAR SIR: I have the honor to acknowledge receipt of your letter, bearing date November 19, asking for information touching the tonnage of freight moved over the railroads to and from Fayetteville.

Replying to this inquiry, I am very sorry to have to say that I can not give you the information as you desire it, as we do not receive at this office the tonnage movement from each station along the various lines of railroads in the State: but we do get the total tonnage of freight from the entire road, which compilation gives the freight originating on the road and freight received from connecting roads, together being the total freight tonnage handled by the road. This information I take pleasure in furnishing you, which you will find herewith inclosed.¹ Table No. 1 is compiled from the last statement of the Cape Fear and Yadkin Valley Railway Company; Table No. 2 is for the Wilmington and Weldon Railroad (main line), including Wilson and Fayetteville branch and other of its branches proper.

I trust the statements will enable your committee to make an estimate of Fayetteville's proportionate amount of this tonnage. I am very glad to know that some steps are being taken toward opening up the Cape Fear River between Wilmington and Fayetteville, and I trust the Government will see the importance of this station, which by reason of its situation should again become the distributing point for the central and western North Carolina territory.

I am, sir, very respectfully,

H. C. BROWN,
Clerk.

Hon. E. J. HALE,
Chairman Citizens' Committee, Fayetteville, N. C.

LETTER OF THE WILMINGTON (N. C.) CHAMBER OF COMMERCE.

THE WILMINGTON CHAMBER OF COMMERCE,
Wilmington, N. C., November 19, 1900.

DEAR SIR: Your letter of the 12th duly received and referred to our committee on harbor, shipping, and commerce. Our chamber appointed a committee December 21, 1899, to ask for anchorage basin at Wilmington, feeling that the size and importance of our port, the largest and only deep-water port in the State, upon which the Government has expended large sums to give it 20 feet of water, require and need an anchorage basin, at which ships coming here can swing in safety,

¹Detailed figures omitted by Captain Lucas. The total tonnage amounts to 1,137,941 for Wilmington and Weldon Railroad; 360,032 for Cape Fear and Yadkin Valley Railway; total, 1,497,979.

the present channel being too narrow to allow this. We are not prepared to care for vessels that this increased depth of water gives us. Our business has and is materially increased each year, and with this basin we will be in position to care for many more vessels and increased commerce.

This being a fresh-water port south of Hatteras, makes it particularly desirable for the shelter and care of smaller war ships and torpedo boats. From our geographical position we are particularly well situated for steamers trading between Cuban and Porto Rican ports, it being a shorter and safer route than any port north of Hatteras. We have good railroad facilities, capital, and energy, which will unite and make good use of these needed improvements. We are not prepared at this time to give statistics showing the present commerce of this port. This, no doubt, you have on file in your office, but if we can do anything to obtain this much-desired basin we will be pleased to do so.

Navigable rivers are sure and steady feeders, and those living near such streams receive many direct and indirect benefits. Before the time of railroads they were the channels upon which commerce moved. To-day they control and adjust rates made by railroads upon which commerce can move freely and cheaply. Therefore how necessary to the welfare of a country.

The Cape Fear River has been the great gateway for the people of North Carolina for many years, and even with its uncertain waters, being navigable only about eight months in the year, and then only to boats of very light draft—2 feet or under—has proven of inestimable value to the section through which it runs and is tributary thereto, particularly to the port of Wilmington. With increased depth of water, say 6 feet, the year round an immense tonnage will come this way, the people of our State will be materially benefited thereby, and the commerce and future of Wilmington be assured.

Our chamber appreciates highly the services rendered by you and the marked improvement of our river under your administration, and will gladly cooperate with you in any and all things tending to the continuance and improvement of this needed work.

Very respectfully,

MARCUS W. JACOBI,
President.

Capt. E. W. VAN C. LUCAS,
Corps of Engineers, U. S. A.

LETTER OF THE WILMINGTON (N. C.) PRODUCE EXCHANGE.

WILMINGTON PRODUCE EXCHANGE,
Wilmington, N. C., November 19, 1900.

SIR: Replying to your favor of the 12th, the Produce Exchange heartily indorses the projects for dredging an anchorage basin at Wilmington and for obtaining a channel of 4 feet, 6 feet, or 8 feet depth throughout the year between Wilmington and Fayetteville.

First, as to the anchorage basin: The greatest width available for anchorage at Wilmington is 600 feet, just below the confluence of the Cape Fear and Northeast rivers, directly opposite the city, where the river is necessarily most crowded with vessels. This not only greatly interferes with the commerce of the port by rendering the passing of vessels very difficult, but at best is far too narrow to afford anchorage for the vessels coming to this port, as evidenced by the frequent grounding of vessels within this harbor on account of insufficient room for anchorage. The harbor master advises us that within the past year 25 to 30 vessels, drawing from 17 to 20 feet, have grounded in the lower harbor, as there is not sufficient room at that anchorage for the vessels to swing clear. The harbor master kept no record of these vessels, but the following have come under our special notice as having grounded within the past few months, namely: Bark *Francis S. Hampshire*, drawing 17½ feet; barge *Carrie L. Tyler*, drawing 17½ feet; steamship *Strathord*, drawing 19½ feet; steamship *Dora*, drawing 18 feet; steamship *Muthilda*, drawing 21½ feet.

Wilmington is the only port for foreign commerce in North Carolina, and the improvements made in the Cape Fear River below the city and on the bar, increasing the depth of the river from 12 to 20 feet and the water on the bar from 12 to 24 feet, enable vessels of a much larger class than heretofore to come to this port, which demands better facilities for anchorage than heretofore, and, as shown above, clearly demonstrates the insufficiency of present anchorage ground. The improvements above referred to have increased the annual commerce to and from

this port by water to over \$35,000,000. However, each year greater difficulty is experienced in chartering vessels to come to this port on account of the knowledge of its insufficient anchorage spreading among the owners of vessels. This is seriously jeopardizing the present commerce of the port and preventing a much larger increase thereof.

Further, the proposed anchorage basin would serve as a fresh-water station for war vessels and cruisers of light draft, especially for torpedo boats and torpedo-boat destroyers, and would be the first available harbor south of the Chesapeake Bay.

Second, as to a channel of 4 feet, 6 feet, or 8 feet depth throughout the year from Wilmington to Fayetteville: The present annual tonnage above Wilmington on the Cape Fear River exceeds 115,000 tons, notwithstanding the fact that transportation by water between these points is at all times precarious, and during four months of the year well-nigh totally suspended on account of insufficient depth of water. If a channel of even 4 feet depth throughout the year could be obtained, so that transportation by water between these ports would be certain, a cheaper, shorter, and more direct route from Fayetteville to all markets would be secured in connection with the ocean steamers at Wilmington instead of by Norfolk, as at present; the fertile lands along the river would become available for trucking and other agricultural purposes now prohibited by absence of certain and quick transportation facilities; and shipments from this port by the river would soon reach 500,000 tons or more each year.

For these and many other reasons that might be assigned we firmly believe that an adequate anchorage basin for this harbor is an imperative necessity to maintain our present commerce, and that it would result in very largely increasing the same; also, that the proposed deepening of the channel between Wilmington and Fayetteville would prove a very material public benefit. In view of the interests involved and of the very great benefits that would accrue to the whole State from the carrying out of the proposed projects, we know of no object more worthy of the favorable consideration of those to whom these matters are to be submitted.

Thanking you for the courtesy in placing this matter before us, as also for the interest by you manifested in all things pertaining to the betterment of this port, we are

Very respectfully,

H. W. MALLOY,
H. G. SMALLBONES,
W. H. SPRUNT,
C. H. ROBINSON,
G. J. BONEY,
D. McEACHERN,

Committee, Produce Exchange, Wilmington, N. C.

Capt. E. W. VAN C. LUCAS,
Corps of Engineers, U. S. A.

LETTER OF THE WILMINGTON (N. C.) MERCHANTS' ASSOCIATION.

WILMINGTON, N. C., November 20, 1900.

SIR: The undersigned, having been appointed by the Merchants' Association of Wilmington a committee to advocate the adoption by the General Government of the projects provided in the river and harbor bill of last June under survey by the Corps of Engineers, United States Army, (1) for an anchorage basin at Wilmington, and (2) for a channel of 4 feet, 6 feet, or 8 feet depth, throughout the year, between Wilmington and Fayetteville, respectfully represent:

First. That the need of a safe anchorage in the port of Wilmington increases yearly with the progress of the bar and river improvements under the direction of the United States Engineers, and with a corresponding increase in the draft of larger vessels adapted to our growing commerce.

The channel from Cape Fear Bar to Wilmington, and at Wilmington, is only about 150 feet wide. This width barely accommodates the passage of large ships and is quite inadequate for anchorage at Wilmington. The depth of this dredged channel referred to is 20 feet; the outside of the channel in the lower harbor at Wilmington is only 13 feet to 15 feet depth. It is, therefore, obviously impossible to moor vessels of 18 feet to 21 feet draft and of 325 feet to 350 feet length in the stream without incurring great risk of grounding on their anchors, or of fouling moving craft in the fairway or mid-channel.

The lower harbor of Wilmington is a fresh-water, land-locked bay, about 1,200 feet wide and 2 miles long, well adapted for the anchorage and protection of a

large fleet of vessels, and for naval maneuvers, if the bottom was dredged to a depth of 28 feet in order that vessels drawing 22 feet may safely ride over the stocks and flukes of their anchors, which would require a depth of 6 feet more than that of the river and bar. In short, the work of the river and harbor is manifestly incomplete without this necessary accommodation to ships in port.

We are informed by the harbor master of Wilmington that more than thirty vessels have grounded under way and at anchor in the lower harbor within a year past, these casualties having been caused by insufficient water outside of the dredged channel in which to swing the vessels to their anchors. Several of these cases of stranding were of a serious character, the damage to a few loaded vessels resulting in general average claims. It should be understood that vessels arriving with inward cargo are required to anchor in the stream and wait orders for discharging, and that these incur the greatest risk of grounding, of obstructing the channel, and of collision with moving vessels.

The bottom of the lower harbor is also dangerous to navigation, being hard sand in which submerged logs have been embedded, thereby causing risk of damage to vessels' bottoms and to the screws of steamships passing over it.

It is estimated that the commerce of Wilmington for the year 1900 will approximate in value \$40,000,000. The tonnage of this port has more than doubled since the record of 1877 and 1878.

Second. We are also instructed to support with exact information and statistics the scheme for navigable water at all seasons of the year between Fayetteville and Wilmington. We have endeavored to collect and classify facts bearing upon this project, but the limited time at our disposal for a reply expired before we could obtain the desired data, which is not systematically recorded because of the desultory, irregular means of transportation throughout the year. We therefore offer the following remarks by a member of this committee whose long-established business relations with the Upper Cape Fear River enable him to speak with authority on this subject:

"As reported to the engineer's office for the year 1899, the tonnage over this route was about 115,000 tons, and there is reason to believe that this is an underestimate, for of necessity there is a large amount that comes to this port by modes of conveyance, such as rafts, flats, etc., which are not of record. A fairer estimate would be of not less than 125,000 tons.

Referring to the report of the Engineer in Chief of last year, there will be found this statement: "Of late years appropriations have been so small as to suffice for snagging only; there has been, in consequence, a considerable deterioration of jetties, and shoaling." The result of this state of affairs has been that the traffic which has passed over this route has been confined to a period of from eight to nine months during the year. There has been a total lack of continuous, regular traffic. Our opinion, based on knowledge of the present conditions and the capabilities of the sections traversed by this route, is that anything conducing to a regular and certain transportation would not only largely increase the existing lines of production, but stimulate the inauguration of entirely new enterprises.

During the time when traffic by this river is uncertain or impracticable, large quantities of produce which would naturally seek an outlet by this route have to be hauled long distances over sandy roads to railroads. Or, if their nature is perishable, they are wasted entirely for lack of transportation. Certain communities are for long periods not only cut off from outside markets for their productions, but suffer for reasonable mail facilities.

The proposed establishment of certain transportation would enable business transactions otherwise impossible where there is uncertainty as to when produce could be delivered. Certainty of transportation would turn into its natural channels trade that is now diverted elsewhere because of lack of natural competition. There would be a reduction of rail rates to meet the water competition, and a large increase of outgoing freight from this port would result.

If it be practicable to establish such a channel and give certain transportation, it would result, to be brief, in increase of tonnage in lines now represented, development to a wonderful extent of the country traversed by the introduction and establishment of new industries for which it is peculiarly adapted, promoting better mail and passenger accommodations, and inaugurating reasonable water competition to rail rates.

The members of this committee feel that their duty to the merchants' association would be unfulfilled without an expression to you of its recognition and high appreciation of the skillful and faithful service rendered to this port by the Engineer Corps from the beginning of the bar and river improvement to the present time.

The closure of New Inlet, the removal of formidable natural obstructions from the river bed, the experimental jetties at Snows Marsh, the admirably designed and effective bar dredger *Cape Fear*, and the deepening of navigable water from 12 feet to 20 feet alike attest the entire success of one of the most scientific and economical projects ever devised by this valuable arm of the General Government in the river and harbor work.

We are, sir, yours, obediently,

JAMES SPRUNT,
C. W. WORTH,
R. W. HICKS,

Committee from the Merchants' Association of Wilmington, N. C.

Capt. E. W. VAN C. LUCAS,
Corps of Engineers, U. S. A.

LETTER OF MESSRS. ALEXANDER SPRUNT & SON.

WILMINGTON, N. C., *November 13, 1900.*

SIR: In response to your request of November 12 for a statement from us in reference to the Government project for an anchorage basin at this port, we respectfully submit the following:

The business of our firm employs 3 cotton compresses and 500 laborers at this port, and 100 agents and cotton buyers in the interior of North Carolina, South Carolina, and Georgia, who buy for us and ship to Wilmington by rail and by inland waterways a quarter of a million bales of cotton annually, the approximate value of which at current prices is \$12,500,000.

This cotton is by us shipped in steamers chartered by us to ports abroad, and some of these ships employed by us bring return cargoes of commercial fertilizers. This is only a part of the trade in Wilmington in cotton and in kaintit. A large business is also done in lumber and in naval stores, and there is an increasing import of chemicals and salt for fertilizing cotton and tobacco fields.

The port of Wilmington formerly employed sailing vessels and small steamers about 200 feet in length. These light-draft craft could easily anchor in the harbor or proceed to wharves without serious risk in favorable weather. In recent years this port has employed a much larger class of steamers, measuring from 325 feet to 380 feet in length, for which there is no room to anchor in the stream without constant danger of grounding on their anchors and of obstructing the dredged channel, which is only about 200 feet wide. The need of an anchorage basin is obvious. The port requires a depth for mooring the largest vessels which the bar will admit, with sufficient swinging room to clear the river channel, which should be unobstructed at all times.

In this connection we will recall the fact that Captain Coghlan, of the U. S. cruiser *Raleigh*, which visited this port last year, stated to the writer that he would gladly bring his ship up to Wilmington if there was sufficient room in the harbor for the *Raleigh* to swing to her anchors. Captain Coghlan added that we needed an anchorage basin badly, and that if he could help the Wilmington people with his official testimony to obtain it they were welcome to his assistance at any time.

There is no lack of space in the harbor, which would afford anchorage and shelter to a large fleet if there was sufficient depth of water.

Yours, obediently,

Capt. E. W. VAN C. LUCAS,
Corps of Engineers, U. S. A.

ALEX. SPRUNT & SON.

L 21.

ESTIMATE OF COST OF REMOVING OBSTRUCTIONS AT MOUTH OF
BRUNSWICK RIVER, NORTH CAROLINA.

[Printed in Senate Doc. No. 130, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, January 28, 1901.

SIR: I have the honor to return herewith concurrent resolution of Congress, adopted by the Senate January 25, 1901, and concurred in by the House of Representatives the same date, as follows:

Resolved by the Senate (the House of Representatives concurring), That the Secretary of War be directed to transmit to the Senate an estimate of the cost of removing the obstructions at the mouth of Brunswick River, North Carolina—

and in compliance with the terms of said resolution to report that the work of removing the obstructions at the mouth of Brunswick River, North Carolina, will, it is estimated by the local engineer officer, Capt. E. W. Van C. Lucas, Corps of Engineers, cost \$1,000.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen. Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

L 22.

ESTABLISHMENT OF HARBOR LINES IN PAMLICO RIVER AT WASHINGTON, NORTH CAROLINA.

WASHINGTON, N. C., *July 17, 1900.*

SIR: We, the undersigned citizens of Washington, N. C., respectfully petition that the harbor line for the port of Washington, N. C., on Pamlico River, be established.

WALLING LUMBER COMPANY,
W. B. WALLING, *President,*
And others.

The Honorable SECRETARY OF WAR.

* * * * *

[Second indorsement.]

U. S. ENGINEER OFFICE,
Wilmington, N. C., August 1, 1900.

Respectfully forwarded to the Chief of Engineers, recommended for approval.

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 4, 1900.

Respectfully returned to Captain Lucas, attention being invited to the provisions of section 11 of the river and harbor act of March 3, 1899.

If, in Captain Lucas's opinion, the establishment of harbor lines at Washington, N. C., is necessary for the preservation and protection of the harbor, he will submit a tracing showing the lines he may recommend for adoption.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[Fourth indorsement.]

U. S. ENGINEER OFFICE,
Wilmington, N. C., September 14, 1900.

Respectfully returned to the Chief of Engineers.

The establishment of harbor lines at Washington, N. C., is not absolutely necessary for the preservation of its harbor, because no structure can be built there without the authority of the Secretary of War, required by section 10, river and harbor act of March 3, 1899.

But the establishment of harbor lines would save considerable future work at the district office, the Chief of Engineers' office, and the Sec-

retary of War's office, by obviating the necessity of forwarding a separate application for the Secretary's approval in each particular case. It would also save to the applicants considerable loss of time incident to forwarding to Washington for such approval, which is, I understand, the principal reason why the within petition, signed by the leading shippers of the place, was submitted.

For reasons above described, the recommendation for approval in the second indorsement was made, and, if they be deemed sufficient, the accompanying tracing¹ shows the harbor lines which are recommended for adoption. In the event of its approval, it is recommended that the three projecting piers at A, B, and C be permitted to remain as at present, but that no future repair or renewal of same outside of the harbor line be permitted.

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 19, 1900.

Respectfully returned to Captain Lucas.

This office is in doubt as to the scope of Captain Lucas's recommendation, whether it is intended to recommend the adoption of both the lines indicated on the map as having been suggested by Capt. W. H. Bixby or only one of them.

It is suggested that the line or lines recommended be drawn solid, that present legends be erased, and that they be marked "Proposed pierhead line," or "Proposed pierhead and bulkhead line," etc., as the case may be.

By command of Brig. Gen. Wilson:

CHAS. S. BROMWELL,
First Lieutenant, Corps of Engineers.

[Sixth indorsement.]

U. S. ENGINEER OFFICE,
Wilmington, N. C., October 3, 1900.

Respectfully returned to the Chief of Engineers.

The intention of the fourth indorsement was to recommend both of the old lines suggested by Capt. W. H. Bixby, the inner one as the limit for solid structures, and the outer one as the limit for open-work structures.

The suggestion in fifth indorsement has been complied with and tracing returned herewith under separate cover.

"Pierhead line" is understood to mean a limiting line for open structures, and "Bulkhead line" a limiting line for solid structures.

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

[Seventh indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 9, 1900.

Respectfully forwarded to the Secretary of War.

Application is made by citizens of Washington, N. C., for establishment of harbor lines in Pamlico River at that place.

¹ Not printed.

The matter has been considered by Capt. E. W. Van C. Lucas, Corps of Engineers, the local officer, and his reports on the subject will be seen by reference to fourth and sixth indorsements hereon.

I recommend that the lines suggested by him and shown on the accompanying tracing be approved, and that the Secretary place his approval on the map which has been prepared for his signature.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on map mentioned were approved by the Secretary of War October 11, 1900, the approval being indicated on the map.

L 23.

ESTABLISHMENT OF HARBOR LINES IN CAPE FEAR RIVER AT SOUTH-
PORT, NORTH CAROLINA.

SOUTHPORT, N. C., *May 24, 1900.*

SIR: The authorities of the city of Southport respectfully ask that you establish a dock line opposite and above the city of Southport, at a depth of about 20 feet at mean low water.

Very respectfully,

JAS. A. WILLIAMS, *Mayor.*
M. C. GUTHRIE, *Clerk.*

Maj. VAN C. LUCAS,
U. S. Engineer Office, Wilmington, N. C.

* * * * *

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 26, 1900.

Respectfully submitted to the Secretary of War.

The authorities of the town of Southport, N. C., having requested the establishment of harbor lines in the Cape Fear River opposite and above said town, the subject has been under consideration by Captain Lucas, the district officer, who submits the accompanying tracing,¹ on which are delineated pierhead and bulkhead lines, which he states are satisfactory to all interests.

I recommend that the lines be approved, and that the Secretary place his approval on the tracing which has been prepared for his signature.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of September 28, 1900, the approval being indicated on the map.

APPENDIX M.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

REPORT OF CAPT. J. C. SANFORD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Waccamaw River, North Carolina and South Carolina. | 9. Congaree River, South Carolina, from Gervais Street Bridge, Columbia, to Granby. |
| 2. Little Pedee River, South Carolina. | 10. Harbor at Charleston, South Carolina. |
| 3. Great Pedee River, South Carolina. | 11. Wappoo Cut, South Carolina. |
| 4. Georgetown Harbor, South Carolina. | 12. Beaufort River, South Carolina. |
| 5. Winyah Bay, South Carolina. | 13. Removing sunken vessels or craft obstructing or endangering navigation. |
| 6. Santee River, South Carolina. | |
| 7. Wateree River, South Carolina. | |
| 8. Congaree River, South Carolina. | |

EXAMINATIONS AND SURVEYS.

- | | |
|--|-----------------------------------|
| 14. Great Pedee River, South Carolina. | 15. Ashley River, South Carolina. |
|--|-----------------------------------|
-

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 19, 1901.

GENERAL: I have the honor to transmit herewith my annual reports for the fiscal year ending June 30, 1901, for the works of improvement of rivers and harbors in this district.

Very respectfully, your obedient servant,

J. C. SANFORD,
Captain of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

M I.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 848, annual report for 1880.
For map of river see page 1200, annual report for 1889.

WORK OF PAST YEAR.

Owing to the small balance available, nothing could be done except to remove the most troublesome obstructions from the channel between the mouth and a point about 122 miles above. The work was done by the self-propelling snag boat belonging to this and other works. She removed from the channel 523 logs, 175 stumps, and 385 snags. Six-hundred and twenty-four overhanging trees and 2 cords of brush were cut. Miles run, about 350. All the expenditures during the year, \$1,283.89, were for maintenance. This amount, together with previous expenditures for maintenance, about \$25,325.94, should properly be added to the amount given in money statement below as estimated amount required to complete the project. As soon as funds are available it is proposed to make a survey of the shoals in this river to ascertain present conditions, with a view to revision if found necessary of the estimate for completing the project.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended	\$1,596.25
June 30, 1901, amount expended during fiscal year	1,283.89
July 1, 1901, balance unexpended	312.36
(Amount (estimated) required for completion of existing project	35,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$15,000.00
For maintenance of improvement	4,500.00
	19,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

For this improvement the following appropriations have been made:

By act of Congress—	By act of Congress—
Approved June 14, 1880.....\$15,000	Approved July 13, 1892 \$10,000
Approved March 3, 1881 10,000	Of August 18, 1894..... 6,000
Passed August 2, 1882..... 4,400	Of June 3, 1896..... 6,000
Approved July 5, 1884..... 6,000	Approved March 3, 1899 3,000
Approved August 5, 1886..... 15,000	
Of August 11, 1888..... 15,000	Total
Approved September 19, 1890 12,500	102,900

Total expenditures, including June 30, 1901, \$102,587.64.

COMMERCIAL STATISTICS.

Articles.	1891.		1892.		1893.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	16,446	\$484,114	19,081	\$384,814	13,326	\$274,865
Cotton	1,375	275,000	1,250	175,000	4,307	603,050
Lumber, timber, and cord wood.....	37,559	251,380	38,752	243,800	34,667	206,500
Rice and rice flour	4,634	347,500	5,520	449,755	8,231	501,954
Fish, game, and vegetables					443	8,579
Miscellaneous.....	1,231	123,118	1,500	75,000	2	600
Total.....	61,245	1,481,112	66,103	1,328,369	60,976	1,595,548
INWARD FREIGHTS.						
Miscellaneous.....	15,000	750,000	17,000	850,000	10,000	500,000
Grand total	76,245	2,231,112	83,103	2,178,369	70,976	2,095,548

Commercial statistics—Continued.

Articles.	1894.		1895.		1896.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	18,817	\$416,716	16,855	\$299,728	19,625	\$398,750
Cotton	1,417	198,380	2,273	272,730	2,000	320,000
Lumber, timber, and cord wood...	57,348	379,904	91,065	486,765	153,166	475,000
Rice and rice flour.....	3,544	329,950	5,429	266,910	6,074	425,575
Fish, game, and vegetables.....	639	14,514	818	127,364	1,924	177,000
Miscellaneous.....	15	5,500	26	10,200	49	4,100
Total.....	81,780	1,244,964	116,466	1,463,697	182,838	1,500,425
INWARD FREIGHTS.						
Miscellaneous.....	17,518	875,900	12,000	600,000	20,550	513,750
Grand total	99,298	2,120,864	128,466	2,063,697	203,388	2,314,175

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.				
Naval stores	19,677	\$454,200	15,450	\$342,500
Cotton	2,000	240,000	2,500	300,000
Lumber, timber, and cord wood...	185,900	535,000	206,200	575,000
Rice and rice flour.....	6,313	390,190	8,231	684,405
Fish, game, and vegetables.....	2,344	142,750	744	116,750
Miscellaneous	66	19,250	66	22,625
Total.....	216,300	1,781,390	233,191	2,041,280
INWARD FREIGHTS.				
Miscellaneous	25,000	625,000	25,000	625,000
Grand total	241,300	2,406,390	258,191	2,666,280

Articles.	1899.		1900.	
	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.				
Naval stores	21,022	\$591,062	21,092	\$632,760
Cotton	3,212	514,000	4,000	640,000
Timber, lumber, and cord wood...	329,328	859,990	417,250	938,312
Rice and rice flour.....	10,625	542,750	4,780	346,000
Fish, game, and vegetables.....	880	29,162	650	26,000
Miscellaneous	130	47,000	115	23,000
Total.....	365,197	2,583,964	447,887	2,606,072
INWARD FREIGHTS.				
Miscellaneous	11,625	551,250	15,000	750,000
Fertilizers			5,000	125,000
Grand total	376,822	3,135,214	467,887	3,481,072

The vessels engaged in traffic on this river are steamers and tugboats of from 10 to 300 tons and seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc. At mean low water about 12 feet can be carried from Georgetown to Bucksville, 34 miles; about 7 feet to Toddsville, 38½ miles; about 4 feet to Conway, 50 miles; about 2 feet to Worthams Bridge, 97 miles.

No new line of transportation has been established.

1576 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

List of vessels plying on Waccamaw River, North Carolina and South Carolina, during calendar year 1900.

Name.	Character.	Length.	Breadth.	Depth.	Draft loaded.	Gross tonnage.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	
Bayard Hopkins	Schooner	118	30	9	10.6	269
Wm. Linthicum	do	112	27.6	8	9.6	156
Robt. McClintock	do	96	26.7	7.4	8	154
E. H. Martin	do				8	125
Chas. Linthicum	do	104	26.4	8.2	8.6	131
Waccamaw	do	137.7	33.3	14.5	10.6	458
Venus	do	108	29.4	9.1	11.6	204
Merchant	Side-wheel steamer	147.7	29.6	5.4	5	405
Wm. P. Congdon	Screw tug	75.5	18	7.8		68
Ruth	Side-wheel steamer	81	26	4	3.8	89
S. S. Brewster	Screw tug	77.5	18.5	7.6		50
F. G. Burroughs	Side-wheel steamer	125	22	6	4.5	283
Wm. Elliott	do	101	31	6	4.5	171
Henry Lloyd	Screw tug	40.5	12.2	4.8		13
Fearless	do	58	11	4		18
Pender	do	52.7	14.9	3.4		28
Bertie	do	49.5	9.8	3.5		16
Socastee	Barge	47	12	4	3.5	16
Enterprise	do	41.5	12	3.5	3	17
Willie	Yacht	40	9	4		6
Madge	do	35	7	2		3
Sprite	do	37	8	3		5
Leilah	do	40	8	3		5
Loretta	do	40	9	3		7
Natoma	do	48.4	12	4.2		21
Almont	do	40	8	5		4

M 2.

IMPROVEMENT OF LITTLE PEDEE RIVER, SOUTH CAROLINA

REFERENCE TO PAST REPORTS.

For preliminary examination, see page 1111, annual report for 1887.
For map of river, see page 1214, annual report for 1890.

WORK OF PAST YEAR.

No work was done during the year and no money expended. Previous expenditures for maintenance of the improvement, about \$2,200, should properly be added to the amount given in money statement below as estimated amount required to complete the project. As soon as funds are available it is proposed to make a survey of the localities in this river requiring improvement, in order to ascertain present conditions, with a view to revision if found necessary of the estimate for completing the project.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended	\$250.01
June 30, 1901, amount expended during fiscal year	21.33
July 1, 1901, balance unexpended	228.68
{ Amount (estimated) required for completion of existing project	28,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$10,000.00
For maintenance of improvement	1,000.00
	11,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

For this improvement the following appropriations have been made:

By act of Congress—

Of August 11, 1888.....	\$5,000
Approved September 19, 1890.....	5,000
Approved July 13, 1892.....	5,000
Of August 18, 1894.....	4,000
Of June 3, 1896.....	3,000

Total 22,000

Total expenditures, including June 30, 1901, \$21,771.32.

COMMERCIAL STATISTICS.

Articles.	1891.		1892.		1893.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	763	\$14,040	1,127	\$19,540	1,030	\$20,050
Cotton	78	15,500	150	21,000	175	24,500
Lumber, timber, and cord wood.....	3,315	9,480	5,098	15,424	4,060	12,310
Miscellaneous.....					13	925
Total.....	4,156	39,020	6,375	55,964	5,278	57,785
INWARD FREIGHTS.						
Miscellaneous.....	458	13,740	740	37,000	875	43,750
Grand total	4,614	52,760	7,115	92,964	6,153	101,535

Articles.	1894.		1895.		1896.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	1,075	\$24,600	1,226	\$19,720	1,400	\$29,000
Cotton	150	24,000	312	37,500	500	80,000
Lumber, timber, and cord wood.....	6,250	21,000	10,400	35,250	14,400	64,000
Miscellaneous.....					50	1,500
Total.....	7,475	69,600	11,938	92,470	16,350	174,500
INWARD FREIGHTS.						
Miscellaneous	900	45,000	500	25,000	700	24,000
Grand total	8,375	114,600	12,438	117,470	17,050	198,500

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.				
Naval stores	777	\$14,650	850	\$17,500
Cotton	210	31,500	375	45,000
Lumber, timber, and cord wood	11,500	31,000	10,000	20,000
Miscellaneous.....	200	10,000	200	10,000
Total.....	12,687	87,150	11,425	92,500
INWARD FREIGHTS.				
Miscellaneous.....	475	13,250	475	13,250
Grand total	13,162	100,400	11,900	105,750

Commercial statistics—Continued.

Articles.	1899.		1900.	
	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.				
Naval stores.....	1,250	\$27,587	400	\$12,000
Cotton.....	475	76,000	250	40,000
Lumber, timber, and cord wood.....	14,400	25,200	20,000	40,000
Total.....	16,125	128,787	20,650	92,000
INWARD FREIGHTS.				
Fertilizers.....			3,000	75,000
Miscellaneous, general merchandise.....	560	16,000	130	6,500
Grand total.....	16,685	144,787	23,780	173,500

The river commerce is carried on by one steamer of about 60 tons, making occasional trips when the stage of water permits, and by pole boats, rafts, etc. Were it not for snags, about 3 feet could probably be carried at mean low water to the head of navigation.

No new line of transportation was established during the year.

List of vessels plying on Little Pedee River, South Carolina, during calendar year 1900.

Name.	Character.	Length.	Breadth.	Depth.	Loaded draft.	Gross tonnage.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet. In.</i>	
Ruth.....	Side-wheel steamer...	81	26	4	3 6	89
6 pole flats.....		65	14	3	2 6	30

M 3.**IMPROVEMENT OF GREAT PEDEE RIVER, SOUTH CAROLINA.****REFERENCE TO PAST REPORTS.**

For preliminary examination see page 753, annual report for 1873. For special description see page 845, annual report for 1880, and page 723, annual report for 1879. For map of river see page 1180, annual report for 1889.

WORK OF PAST YEAR.

On account of the small balance available and the necessity of providing from this balance for a preliminary examination and survey of that portion of the river between Cheraw and the Wilmington, Columbia and Augusta Railroad bridge (report printed in House Ex. Doc. No. 124, Fifty-sixth Congress, second session), no snagging work could be done except to remove such obstructions as entirely blocked navigation. The snag boat ran 82 miles, and removed 9 logs, 4 stumps, and 19 snags. The snagging plant was cared for and necessary minor repairs made. Of the expenditures during the year, \$1,795.23 was for maintenance of the channel and plant. This amount, together with previous expenditures for maintenance, about \$30,000, should properly be added to the amount given in money statement below as estimated amount required to complete the project. As soon as funds are available it is proposed to make a survey of the shoals between the

railroad bridge and the mouth, to ascertain present conditions in this portion of the river, so that, with the survey made during the year above the bridge, the amount now required to complete the project can be properly estimated.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended	\$2,983.63
June 30, 1901, amount expended during fiscal year	2,197.99
July 1, 1901, balance unexpended	785.64
July 1, 1901, outstanding liabilities	103.48
July 1, 1901, balance available	682.16
Amount (estimated) required for completion of existing project	5,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$5,500.00
For maintenance of improvement	5,000.00
	10,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

For this improvement the following appropriations have been made:

By act of Congress—

Approved June 14, 1880	\$7,000
Approved March 3, 1881	6,000
Passed August 2, 1882	6,000
Approved July 5, 1884	8,000
Approved August 5, 1886	20,000
Of August 11, 1888	20,000
Approved September 19, 1890	12,500

By act of Congress—

Approved July 13, 1892	\$10,000
Of August 18, 1894	6,000
Passed June 3, 1896	12,000
Approved March 3, 1899	4,000
Total	111,500

Total expenditures, including June 30, 1901, \$110,714.36.

COMMERCIAL STATISTICS.

Articles.	1891.		1892.		1893.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	6,917	\$130,400	7,087	\$141,640	5,117	\$95,255
Cotton	1,483	296,300	1,445	202,300	903	126,350
Lumber, timber, and cord wood	43,649	180,372	72,763	328,448	75,637	325,651
Rice and rice flour	4,483	369,308	4,422	390,950	4,746	206,343
Miscellaneous	250	7,500	352	17,600	413	20,925
Total	56,782	983,880	86,069	1,080,938	86,816	774,524
INWARD FREIGHTS.						
Miscellaneous	5,562	383,450	6,402	320,100	7,845	392,350
Grand total	62,344	1,367,330	92,471	1,401,038	94,661	1,166,874

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Commercial statistics—Continued.

Articles.	1894.		1895.		1896.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores.....	6,856	\$180,340	6,382	\$122,330	6,370	\$152,750
Cotton.....	1,027	213,850	1,500	180,000	1,250	200,000
Lumber, timber, and cord wood....	73,682	301,225	95,363	402,350	209,666	558,500
Rice and rice flour.....	1,203	60,155	1,870	63,750	2,178	99,000
Miscellaneous.....	457	23,500	300	90,000	500	15,000
Total.....	83,225	779,070	105,415	858,430	219,964	1,025,250
INWARD FREIGHTS.						
Miscellaneous.....	7,800	390,000	700	35,000	10,000	300,000
Grand total.....	91,025	1,169,070	106,115	893,430	229,964	1,325,250

Articles.	1897.		1898.		1899.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores.....	6,577	\$138,365	5,503	\$128,043	3,852	\$106,499
Cotton.....	1,797	268,620	2,395	287,100	2,625	420,000
Lumber, timber, and cord wood....	92,335	277,609	51,526	226,442	112,090	575,960
Rice and rice flour.....	1,980	90,000	2,156	122,500	3,080	105,000
Miscellaneous.....	167	8,350	200	10,000	300	14,000
Total.....	102,856	782,944	61,780	774,085	121,947	1,221,459
INWARD FREIGHTS.						
Miscellaneous.....	11,321	384,970	13,500	454,800	12,125	471,250
Grand total.....	114,177	1,167,914	75,280	1,228,885	134,072	1,692,709

Articles.	1900.	
	Tons.	Value.
OUTWARD FREIGHTS.		
Naval stores.....	3,852	\$115,560
Cotton.....	3,000	480,000
Lumber, timber, cord wood, cross-ties, etc.	115,000	920,000
Rice, rough.....	2,475	110,000
Total.....	124,327	1,625,560
INWARD FREIGHTS.		
Fertilizers.....	20,000	500,000
Miscellaneous merchandise.....	10,400	520,000
Grand total.....	154,727	2,645,560

The vessels engaged in traffic on this river are steamers and tugboats of from 10 to 300 tons and seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc.

No new line of transportation has been established during the year.

List of vessels plying on Great Pedee River, South Carolina, during calendar year 1900.

Name.	Character.	Length.	Breadth.	Depth.	Draft loaded.	Gross tonnage.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	
Bayard Hopkins.....	Schooner.....	118	30	9	10.6	269
Wm. Linthicum.....	do.....	112	27.6	8	9.6	156
Robert McClintock.....	do.....	96	26.7	7.4	8	154
E. H. Martin.....	do.....				8	125
J. H. Parker.....	do.....	144.2	34.5	15.3	16	178
Chas. Linthicum.....	do.....	104	26.4	8.2	10	131
Waccamaw.....	do.....	137.7	33.3	14.5	10.6	458
Merchant.....	Side-wheel steamer.....	147.7	29.6	5.4	5	405
Wm. P. Congdon.....	Screw tug.....	75.2	18	7.8		68
Two Brothers.....	Stern-wheel steamer.....	75.1	30.1	5.4	4.5	97
Ruth.....	Side-wheel steamer.....	81	26	4	3.8	89
S. S. Brewster.....	Screw tug.....	77.5	18.5	7.6		50
Louisa.....	Stern-wheel steamer.....	101	25	5	4.5	280
Jno. M. Cole.....	Side-wheel steamer.....	130	39.6	5	4.5	318
Henry Lloyd.....	Screw tug.....	40.5	12.2	4.8		13
Pender.....	do.....	52.7	14.9	3.4		28
Loretta.....	Yacht.....	40	9	3		7
Fearless.....	Screw tug.....	58	11	4		18

M 4.

IMPROVEMENT OF GEORGETOWN HARBOR, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For description of this harbor, project for improvement, and previous operations, see annual reports, 1881, pages 1036-1038; 1892, pages 1183 and 1184, and 1893, pages 1437 and 1438.

WORK OF PAST YEAR.

The dredged cut having shoaled and narrowed, it was redredged during the year so far as the funds remaining since the completion of the work in 1895 would permit. There were removed 7,509 cubic yards of mud, 81 stumps, and 8 logs, restoring the channel across the bar to full depth for a width of about 125 feet. The work was done by hired labor, using Government plant.

The project being completed and no available balance remaining, no further report will be made.

Georgetown is a port of entry. Amount of duties collected in the calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended	\$1,519.29
June 30, 1901, amount expended during fiscal year	1,076.26

July 1, 1901, balance unexpended	443.03
July 1, 1901, outstanding liabilities	443.03

For this improvement the following appropriations have been made:

By act of Congress of 1882	\$7,000
By act of Congress—	
July 5, 1884	5,000
August 5, 1886	5,000
August 11, 1888	7,500
September 19, 1890	8,000
July 13, 1892	12,000
	44,500

Total expenditures to June 30, 1901, \$44,056.97.

COMMERCIAL STATISTICS.

The commercial statistics of Georgetown Harbor are the same as those stated for Winyah Bay in my report on the latter work.

M 5.

IMPROVEMENT OF WINYAH BAY, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For original project see annual report for 1885, page 1164. For report by Board of Engineers see annual report for 1889, page 1114. For reasons for construction of mud dike see annual report for 1895, page 1351.

WORK OF PAST YEAR.

Jetty construction under continuing contract with Mr. R. G. Ross was continued. This contract, approved June 10, 1897, provides for the completion of the jetty work on or before July 1, 1902. The contractor earned during the year \$264,326.97. In the previous fiscal year he had earned \$273,744.27.

From July to April work was done on the south jetty only. The mattress foundation of this jetty was completed in January. In order to hasten the advance of the superstructure and to remove as quickly as possible a shoal which obstructed the entrance in front of the superstructure (at one time during the year this shoal practically closed the entrance), the latter has, since February, been carried up to high-water level only, with steep slopes and narrow crest. In February, March, and April a number of mattresses were sunk on the north side of the south jetty foundation, where a tendency to undermine existed. The suction dredge *Winyah Bay* has worked continuously except when undergoing minor repairs. Her work has been done on the entrance channel parallel to the south jetty, on a channel nearly parallel to the north jetty for the temporary accommodation of shipping, on the Middle Ground Channel, and when weather would not permit her working on the bar, on a troublesome shoal within the bay.

The accompanying map of survey just made shows, as compared with the map accompanying my report of last year, a marked improvement, especially in width of entrance channel, where a decided scour has occurred. The shoal which obstructs the entrance has moved rapidly seaward as the south jetty superstructure has advanced, and has greatly diminished in size. There is an available depth of 12 feet at mean low water from the ocean to the bay.

For details of the year's work reference is made to the accompanying report of Assistant Engineer Reid Whitford, who has been in local charge of this work, as well as of the improvement of rivers tributary to Winyah Bay.

The sundry civil act approved March 3, 1901, contains the following item of appropriation:

Improving Winyah Bay, South Carolina: For continuing improvement of harbor at Winyah Bay, five hundred thousand dollars.

Work being now in progress on both jetties, so that it can proceed under nearly all conditions of weather, it is believed that a large amount of jetty work will be done during the coming year.

The estimate in money statement below of funds needed is intended to provide for dredging in order to obtain as quickly as possible a channel of the required depth and width and for maintenance.

Winyah Bay is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended	\$556, 734. 78
Amount appropriated by sundry civil act approved March 3, 1901	500, 000. 00
	1, 056, 734. 78
June 30, 1901, amount expended during fiscal year	304, 173. 73
	752, 561. 05
July 1, 1901, balance unexpended	752, 561. 05
July 1, 1901, outstanding liabilities	106, 495. 38
	646, 065. 67
July 1, 1901, balance available	646, 065. 67
July 1, 1901, amount covered by uncompleted contracts	489, 897. 77
	352, 750. 00
Amount (estimated) required for completion of existing project.	352, 750. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$100, 000. 00
For maintenance of improvement	25, 000. 00
	125, 000. 00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

Amount and date of all appropriations for this work are as follows:

By act of Congress—

Approved August 5, 1886	\$18, 750
Of August 11, 1888	100, 000
Approved September 19, 1890	100, 000
Approved July 13, 1892	100, 000
Of August 18, 1894	110, 000
Passed June 3, 1896	20, 000
Approved June 4, 1897	350, 000
Approved July 1, 1898	450, 000
Approved March 3, 1899	58, 500
Approved June 6, 1900	285, 000
Approved March 3, 1901	500, 000

Total..... 2, 092, 250

Total expenditures, including June 30, 1901, \$1,339,688.95.

List of contracts in force.

Contract for—	Name of contractor.	Date of approval.	Date of beginning.	Date of completion.
Constructing jetties at Winyah Bay.	R. G. Ross.....	June 10, 1897	July 1, 1897	July 1, 1902

COMMERCIAL STATISTICS.

Articles.	1896.		1897.		1898.		1899.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.								
Naval stores	39, 550	\$618, 000	33, 500	\$518, 000	32, 000	\$482, 500	23, 249	\$538, 550
Cotton	2, 500	400, 000	2, 100	320, 000	2, 750	396, 000	3, 735	597, 560
Lumber, timber, and cord wood	78, 623	680, 100	60, 738	362, 500	41, 250	268, 750	48, 397	356, 955
Rice and rice flour	9, 170	512, 250	12, 645	707, 700	11, 243	774, 630	13, 086	665, 788
Fish, game, and vegetables	1, 083	20, 000	458	13, 750	325	20, 000	1, 654	168, 500
Miscellaneous	10, 633	1, 048, 000	10, 633	1, 146, 000	9, 735	1, 046, 000	866	1, 160, 500
Total	141, 559	3, 278, 350	120, 074	3, 067, 950	97, 303	2, 987, 880	90, 987	3, 487, 853
INWARD FREIGHTS.								
Miscellaneous	29, 500	2, 950, 000	29, 300	2, 750, 000	27, 700	2, 600, 000	29, 600	2, 850, 000
Grand total	171, 059	6, 228, 350	149, 374	5, 817, 950	125, 003	5, 587, 880	120, 587	6, 337, 853

Commercial statistics—Continued.

Articles.	1900.	
	Tons.	Value.
OUTWARD FREIGHTS.		
Naval stores	17,865	\$427,878
Cotton	2,428	437,085
Rice and rice flour	11,890	751,832
Lumber, shingles, and cross-ties	63,400	409,638
Fish, game, and vegetables	1,750	175,000
Miscellaneous	1,156	1,548,000
Total	98,489	3,749,433
INWARD FREIGHTS.		
Miscellaneous	31,150	3,000,000
Grand total	129,639	6,749,433

One new line of transportation was established, consisting of two ocean steamships, the *Georgetown* and the *Waccamaw*, belonging to the Atlantic Coast Lumber Company, and plying between Georgetown and New York. These vessels are described in the list of vessels below.

List of vessels at and entering port of Georgetown, S. C., during the calendar year 1900.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		<i>Fect.</i>	<i>Fect.</i>	<i>Fect.</i>	
Merchant	Side-wheel steamer	147.7	29.6	5.4	405
Wm. P. Congdon	Screw steamer	75.2	18	7.8	68
Two Brothers	Stern-wheel steamer	75.1	30.1	5.4	97
Ruth	Side-wheel steamer	81	26	4	89
S. S. Brewster	Screw steamer	77.5	18.5	7.6	50
Louisa	Stern-wheel steamer	101	25	5	280
F. G. Burroughs	Side-wheel steamer	125	22	6	283
John M. Cole	do	130	39.6	5	318
Martha Helen	Screw steamer	82	16.7	7.4	75
Frank Sessoms	Stern-wheel steamer	86.6	22.8	3.6	79
Bon Accord	Screw steamer	67.3	14.4	5	42
Wm. Elliott	Side-wheel steamer	101	31	6	171
Henry Lloyd	Screw steamer	40.5	12.2	4.8	13
Fearless	do	58	11	4	18
Emma A. Twiggs	do	53	13.2	4.5	16
Pender	do	52.7	14.9	3.4	28
Bertie	do	49.5	9.8	3.5	16
Etta	Sloop	47	11	3.3	8
Winyah	Schooner	43.2	16.4	6.1	18
Socastee	Barge	47	12	4	16
Flora Temple	Sloop	34.8	12.8	3.3	7
Blanche Creamer	Schooner	46.1	14.4	4	15
We Go	do	44	13.7	4.3	18
Hugh	do	47.6	14.2	3.4	14
Clipper	Sloop	31	11	2.9	10
Leila	do	31	10	2.5	8
Liza Jane	do	40.8	12.5	4.9	17
Enterprise	Barge	41.5	12	3.5	17
E. T. Williams	Screw steamer	81	21	9	97
Saginaw	Screw steamship	238	34.3	17.1	1,835
Richmond	do	206	33	21.6	1,437
Oneida	do	205.8	29.9	18.6	1,322
Eutaw	Side-wheel steamer	156	29.8	7.8	547
Planter	do	155	32.8	9.1	499
Waccamaw	Schooner	137.7	33.3	14.5	458
E. A. Danenhower	do	116.6	30.2	8.7	228
Cherubim	do	67.8	24.7	7.2	98
Nellie Floyd	do	136	33	15.4	457
Bayard Hopkins	do	118	30	9	269
Wm. Linthicum	do	112	27.6	8	156
Robert McClintock	do	96	26.7	7.4	154
Warren B. Potter	do	130	32.4	12	368
Chas. H. Sprague	do	122	30.7	9.5	318
Jno. C. Gregory	do	140	33.8	10.1	379
Willie L. Maxwell	do	131.6	32.7	9.5	315
Oliver Scofield	do	130	31.5	14.6	393
Eliza A. Scribner	do	128.4	20	9.2	398
Ida C. Schoolcraft	do	134.3	32.6	9.6	320
J. H. Davis	do	37	11	3.3	13

List of vessels at and entering port of Georgetown, S. C., etc.—Continued.

Name.	Character.	Length.	Breadth.	Depth.	Gross tonnage.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	
Charles C. Lister.....	Schooner.....	127	33	9.3	280
Puritan.....	do.....	85.5	28.7	7.3	116
Wilson and Hunting.....	do.....	152	35	11.6	418
J. H. Parker.....	do.....	144.2	34.5	15.3	548
Emma S.....	do.....	64	20	5.5	50
John I. Snow.....	do.....	107.8	26.5	7.3	196
Myra W. Spear.....	do.....	99.2	27.6	7.5	156
B. I. Hazard.....	do.....	131.8	31.1	8.4	392
George R. Congdon.....	do.....	133	32.4	14.8	458
E. H. Martin.....	do.....				125
Rebecca R. Douglass.....	do.....	138.8	33.9	9.5	475
Percy and Lillie.....	do.....	141	33.5	14.1	503
Golden Ball.....	do.....	124.2	30.3	10.5	286
May A. Fisher.....	do.....				125
Chas. Linthicum.....	do.....	104	26.4	8.2	131
J. A. Beckman.....	do.....	140.7	34.2	16.1	485
Venus.....	do.....	108	29.1	9.1	204
Willie.....	Yacht.....	40	9	4	6
Madge.....	do.....	35	7	2	3
Sprite.....	do.....	37	8	3	5
Lillah.....	do.....	40	8	3	5
Advance.....	do.....	25	5.5	1.5	2
Loretta.....	do.....	40	9	3	7
Husted.....	do.....	42	8	3	5
Syra.....	do.....	36	7	3	3
Chicora.....	do.....	25	5	2	2
Thistle.....	do.....	43.6	11.5	3.9	13
Natoma.....	Naphtha launch.....	48.4	12	4.2	21
Pelican.....	do.....	30	7	2.5	3
Wapella.....	do.....	30	7	2.5	3
Georgetown.....	Screw steamship.....	256	42	14	1,359
Waccamaw.....	do.....	256	42	14	1,359
Almont.....	Yacht.....	40	8	5	4
Gardenia (formerly S. V. White).	Stern-wheel steamer.....	75	12.6	3.2	34

The following letters are furnished by Mr. W. D. Morgan, mayor of Georgetown, and Mr. E. B. Freeman, vice-president Atlantic Coast Lumber Company:

MAYOR'S OFFICE,
Georgetown, S. C., June 26, 1901.

DEAR SIR: Inclosed find commercial statistics for Georgetown and Winyah Bay, South Carolina, for the year 1900. It shows a slight increase in the total amount over the previous year. The most notable increase in volume of any item was of lumber. This will show a greater increase another year, and when the extensive plant of the Atlantic Coast Lumber Company is completed and in full working order the exports of lumber from this port will exceed 100,000,000 feet annually.

Another coastwise steamship line was added to the shipping of this port last year, viz, the two ships of the Atlantic Coast Steamship Company, which ply between Georgetown, New York, Boston, and other northern and eastern ports.

We are reliably informed that the new company contemplates building four more ships for the business of this port.

The ocean entrance to Winyah Bay and the port of Georgetown is being deepened in a very satisfactory manner, and justifies the claim made by the United States engineers in charge and the wisdom of Congress in placing the building of the jetties on the contract plan. There is, however, a barrier to the full enjoyment of deep water on the ocean entrance, and that is the shallow condition of the inner bay. We are informed by responsible pilots that there is as much water on the ocean entrance at present as in the inner bay.

Congress should make adequate appropriations for commencing work on the inner bay, which, I understand, has already been surveyed and recommended for improvement. If it were possible to do so, I would like to see this work placed under contract, also, so as to give our growing commerce the full and speedy benefit of deep water from the wharves at Georgetown to the ocean. Besides, in my opinion, the contract system would result in a great saving to the Government.

Yours, very truly,

W. D. MORGAN, Mayor.

Mr. REID WHITFORD,
U. S. Assistant Engineer, Georgetown, S. C.

ATLANTIC COAST LUMBER COMPANY,
Georgetown, S. C., June 26, 1901.

MY DEAR MR. WHITFORD: I beg to submit the following to verify my letter of one year ago:

We have now completed our No. 1 mill, consisting of double-cutting band and resaw; also our No. 2 mill, consisting of two double-cutting bands and resaw; also No. 4 mill, with double-cutting band. These three mills have an aggregate capacity of 250,000 feet per day. No. 3 mill is nearing completion. This mill will have two double-cutting bands and extra large gang, with a capacity of 200,000 feet per day.

We have also completed 30 brick dry kilns for the curing of the lumber, together with one pier 1,600 feet long by 90 feet wide. We also have under construction and nearly complete one storage shed 800 feet by 160 feet. All the above mills will be in full operation before the 1st of January. Total capacity, 450,000 feet per day, or about 125,000,000 feet per annum.

One of the large steel steamers referred to in my former letter is now at the dock taking on 1,750,000 feet of dressed lumber for Canada. These steamers, as you are aware, have been plying regularly between this port and northern ports since August last.

Our shipments from this port for the past twelve months have been about 25,000,000 feet.

We have been considerably inconvenienced, and have not been able to load these steamers to their full capacity owing to the lack of water, not only over the outer bar, but also within the bay.

We hope your effort in behalf of this harbor, in the way of deepening the channel from this port to the Atlantic Ocean, will be crowned with the greatest success.

With best wishes, I am, yours, very truly,

E. B. FREEMAN, *Vice-President.*

MR. REID WHITFORD,
U. S. Assistant Engineer, Georgetown, S. C.

REPORT OF ASSISTANT ENGINEER REID WHITFORD.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., June 30, 1901.

CAPTAIN: I have the honor to report as follows on improving Winyah Bay, South Carolina, for fiscal year ending June 30, 1901:

Mr. R. G. Ross, contractor, continued the construction of the north and south jetties, using on the latter 57,017.92 square yards mattress foundation, 89,505.76 tons large stone, and 36,846.32 tons small or ballast stone. This extended the jetty built to partial dimensions 2,660 feet to about 6 feet above low water, and 1,975 feet to about 4 feet above that level, leaving still an apron of mattress and ballast stone 2,548 feet in advance of this superstructure, making a total of 21,051 feet from the South Island shore.

The north jetty was extended 1,289 feet in a due easterly direction parallel to the south jetty, using 16,749.38 square yards of mattress foundation, 9,074.07 tons large stone, 6,153.21 tons small or ballast stone, constructing 1,200 feet of the jetty to about 4 feet above low-water level, leaving a mattress foundation about 500 feet in advance of this superstructure.

In placing the large stone in the cross section it was so arranged to make the crest as sharp and the slopes as steep as they would stand.

To prevent further undercutting of the south jetty on the upper or northern side, a number of mats were sunk along the base as a protecting apron. The square yards of mattresses and tons of ballast stone are included in the above amounts, and their positions are shown on the accompanying tracing of a survey of the north jetty, south jetty, and middle ground channels just completed.

The suction dredge *Winyah Bay*, owned and operated by the United States, continued excavating in all three channels, without the service of which it would probably not have been possible to maintain sufficient depth to accommodate the growing commerce of the port. The dredge removed from these channels a total of 327,390.46 cubic yards of material.

In addition to this work the dredge removed a total of 23,702.63 cubic yards from shoal at beacon No. 1, in Winyah Bay, working there only at such times when the water was too rough for operating in the other channels.

The dredge was kept in excellent repair and has been thoroughly overhauled.

NAE OCEAN

Of the total amount expended on the entire work 14 per cent was for maintenance and 86 per cent for improvement.

The accompanying tracing shows a general improvement, both on north jetty and south jetty channels, as also on middle ground channel, all of these having widened and deepened, the controlling depth now being 12 feet on a very narrow strip of shoal in the south jetty channel, which has a decided tendency to disappear as the stone superstructure is advanced seaward. In the north jetty channel the controlling depth is about 10 feet, with a tendency to deepen. The middle ground channel has increased in depth from $11\frac{1}{2}$ to 13 feet. Depths above referred to mean low water.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. J. C. SANFORD,
Corps of Engineers, U. S. A.

M 6.

IMPROVEMENT OF SANTEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For description of river see page 916, annual report for 1880. For full history of work see page 1036, annual report for 1886. For new project and map of river see pages 1184 and 1186, annual report for 1889. For statement showing comparative cost of dredging by contract and by hired labor see pages 1171 and 1172, annual report for 1896, and page 1459, annual report for 1897. For miscellaneous expenses see pages 1458 and 1459, annual report for 1897.

WORK OF PAST YEAR.

Dredging was done in the Estherville-Minim Creek Canal so far as the available funds would permit. The work done consisted in widening and deepening the canal over a length of 1,918 feet and in redredging over a length of 639 feet, where caving of the banks had caused shoaling. In all, 79,443 cubic yards of mud, 257 stumps, and 7 logs were removed.

The sawmill owned by the United States was operated by hired labor for supplying such lumber as was needed from time to time for repair of plant or revetment. A total of 212 logs, of which 198 were cut during the year, were hauled and cut up, making 29,000 feet B. M. of lumber. Forty-seven cords of wood were cut, and 246 cords hauled to the canal bank to be used as fuel for steam plant.

Considerable work was done in reading tide gauges and compiling data for use in connection with a suit brought against the United States by the Lowndes estate for alleged damage to rice-land drainage due to the construction of the Mosquito Creek Canal. This suit was discontinued, at the plaintiff's request, June 28, 1901.

Of the expenditures of the year, \$1,676.08 is chargeable to maintenance. This amount, together with previous expenditures for maintenance, about \$11,000, is added to the amount given in money statement below as estimated amount required to complete the project.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended	\$6,742.32
June 30, 1901, amount expended during fiscal year	6,704.32
July 1, 1901, balance unexpended	38.00
Amount (estimated) required for completion of existing project	194,676.08
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$35,000.00
For maintenance of improvement	13,000.00
	48,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

For this improvement the following appropriations have been made:

By act of Congress—		By act of Congress—	
Approved March 3, 1881 ..	\$22,000	Approved July 13, 1892....	\$30,000
Passed August 3, 1882.....	20,000	Of August 18, 1894.....	40,000
Approved July 15, 1884.....	15,000	Passed June 3, 1896.....	48,000
Approved August 5, 1886....	18,750	Approved March 3, 1899 ...	20,000
Of August 11, 1888.....	24,000		
Approved September 19, 1890	30,000	Total	267,750

Total expenditures, including June 30, 1901, \$267,712.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.		1892.		1893.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	29,187	\$525,000	35,100	\$540,000	40,200	\$552,000
Cotton	5,000	850,000	5,500	800,000	5,500	700,000
Lumber, timber, and cord wood...	34,943	116,400	44,750	155,200	53,400	159,300
Rice and rice flour.....	2,200	150,000	3,220	175,000	30,000	150,000
Fish, game, and vegetables.....	15	1,500	34	1,700	45	2,300
Miscellaneous.....	243	20,700	219	18,900	337	30,500
Total.....	71,588	1,663,600	88,823	1,690,800	129,482	1,594,100
INWARD FREIGHTS.						
Miscellaneous.....	28,667	1,080,000	21,700	1,085,000	21,700	1,085,000
Grand total	100,255	2,743,600	110,523	2,775,800	151,182	2,679,100

Articles.	1894.		1895.		1896.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	31,700	\$482,000	28,250	\$420,000	34,250	\$547,000
Cotton	4,200	575,000	3,750	450,000	3,500	427,000
Lumber, timber, and cord wood...	57,300	223,800	61,900	211,000	72,766	161,600
Rice and rice flour.....	1,600	48,000	3,520	120,000	2,200	95,000
Fish, game, and vegetables.....	34	1,750	50	2,500	150	7,500
Miscellaneous.....	294	19,450	220	21,300	269	11,500
Total.....	95,128	1,350,000	97,690	1,224,800	113,135	1,249,600
INWARD FREIGHTS.						
Miscellaneous.....	20,300	1,025,000	20,000	1,000,000	21,000	955,000
Grand total	115,428	2,375,000	117,690	2,224,800	134,135	2,204,600

Receipts and shipments—Continued.

Articles.	1897.		1898.		1899.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores.....	37,000	\$570,000	37,075	\$577,000	35,400	\$883,500
Cotton.....	4,000	480,000	4,200	495,000	3,750	600,000
Lumber, timber, and cord wood.....	48,850	162,500	44,850	147,500	86,160	223,600
Rice and rice flour.....	21,125	130,000	3,300	160,000	4,400	150,000
Fish, game, and vegetables.....	90	9,000	100	10,000	150	17,500
Miscellaneous.....	241	16,440	280	16,300	267	17,500
Total.....	111,306	1,367,940	89,805	1,405,800	130,127	1,892,100
INWARD FREIGHTS.						
Miscellaneous.....	22,900	792,000	22,400	798,000	24,200	787,000
Grand total.....	134,206	2,159,940	112,205	2,203,800	154,327	2,679,100

Articles.	1900.	
	Tons.	Value.
OUTWARD FREIGHTS.		
Naval stores.....	30,100	\$474,000
Cotton.....	4,200	660,000
Lumber, timber, and cord wood.....	96,400	212,000
Rice and rice flour.....	28,000	140,000
Fish and game.....	40	2,200
Miscellaneous.....	350	34,000
Total.....	159,090	1,522,200
INWARD FREIGHTS.		
Miscellaneous.....	20,000	1,100,000
Grand total.....	179,090	2,622,200

The commerce on the river and canal is carried on by steamers of from 10 to 300 tons, small sailing craft, pole boats, rafts, etc. About 4 feet can be carried at mean low water through the canal and to the head of the Santee River.

No new line of transportation has been established during the year.

The following letter regarding the commerce of the river and canal has been furnished by Mr. Ehrich, of Georgetown, with statistics for 1900. (For several years past he has kindly furnished these statistics, and is well informed as to the value of the Santee traffic.)

GEORGETOWN, S. C., *June 28, 1901.*

DEAR SIR: I beg to hand you herewith a statement of statistics for Santee River for the past year, which I trust you will find in order.

For several reasons the past year was not a good one for agriculture; hence the decrease in cotton and rice. The completion of several new sawmills in Georgetown—in fact, the largest lumber plant in the world being located here, depending somewhat on the Santee River for its supply of logs—has very much increased the receipts of logs. In my last letter I mentioned the importance of the improvement of South Santee, its inland route through to Georgetown by the Minim Creek Canal. The great importance of this improvement is very apparent to anyone familiar with the conditions.

Further, I beg to remain,

Yours, truly,

LOUIS S. EHRIKH.

MR. REID WHITFORD,

U. S. Assistant Engineer, Georgetown, S. C.

1590 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

List of vessels plying on Santee River, South Carolina, during the calendar year 1900.

Name.	Character.	Length.	Breadth.	Depth.	Draft loaded.	Gross tons.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	
Jno. M. Cole.....	Side-wheel steamer.....	130	39.6	5	4.5	318
Frank Sessoms.....	Stern-wheel steamer.....	86.6	22.8	3.6	3	79
Janie.....	Screw tug.....	42.8	10.5	4.5	-----	17
Otto.....	do.....	31.3	11.2	3.7	-----	10
Pender.....	do.....	52.7	14.9	3.4	-----	28
Etta.....	Sloop.....	47	11	3.3	3	8
Flora Temple.....	do.....	34.8	12.8	3.3	3	7
We Go.....	Schooner.....	44	13.7	4.3	4	18
Hugh.....	do.....	47.6	14.2	3.4	3	14
Clipper.....	Sloop.....	31	11	2.9	2	10
Lella.....	do.....	31	10	2.5	2	8
Liza Jane.....	do.....	40.8	12.5	4.9	4	17
Eutaw.....	Side-wheel steamer.....	156	29.8	7.8	7.4	547
Willie.....	Yacht.....	40	9	4	-----	6
Loretta.....	do.....	40	9	3	-----	7
Natoma.....	do.....	48.4	12	4.2	-----	21
Gardinia.....	Stern-wheel steamer.....	75	12.6	3.2	3	34

M 7.

IMPROVEMENT OF WATEREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 914, annual report for 1880. For survey and project for improvement see page 1034, annual report for 1881. For map of river see page 1190, annual report for 1889.

WORK OF PAST YEAR.

Owing to the small balance available, no work was done, except to maintain and care for the snagging plant.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended	\$1,356.58
June 30, 1901, amount expended during fiscal year	724.30
July 1, 1901, balance unexpended	632.28
July 1, 1901, outstanding liabilities.....	69.66
July 1, 1901, balance available	562.62

{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	6,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

For this improvement the following appropriations have been made:

By act of Congress—	By act of Congress—
Approved March 3, 1881 \$8,000	Approved July 13, 1892..... \$2,500
Passed August 2, 1882..... 15,000	Of August 18, 1894..... 2,500
Approved July 5, 1884..... 5,000	Passed June 3, 1896..... 5,000
Approved August 5, 1886.... 7,500	Approved March 3, 1899 2,500
Of August 11, 1888..... 12,000	
Approved September 19, 1890 12,500	Total
	72,500

Total expenditures, including June 30, 1901, \$71,867.72.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.		1892.		1893.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	175	\$1,250	700	\$7,000	3,600	\$36,000
Cotton	210½	25,460	595	30,890	766	40,426
Lumber, timber, and cord wood					17	42
Rice and rice flour	220	12,500	161	8,750	230	10,000
Miscellaneous					12	216
Total	605½	39,210	1,456	46,640	4,625	86,684
INWARD FREIGHTS.						
Miscellaneous	400	12,000	788	39,400	1,617	31,045
Grand total	1,005½	51,210	2,244	86,040	6,242	117,729

Articles.	1894.		1895.		1896.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores	196	\$1,540	193	\$1,375		
Cotton	248	20,070	112	13,500	1,167	\$44,025
Lumber, timber, and cord wood	16,010	40,300	20,010	50,200	30,000	60,000
Rice and rice flour	10	500	22	750		
Miscellaneous	206	5,024	240	5,740	1,825	44,000
Total	16,670	67,434	20,577	71,565	32,992	148,025
INWARD FREIGHTS.						
Miscellaneous	1,345	26,900	1,120	56,000	2,010	85,500
Grand total	18,015	94,334	21,697	127,565	35,002	233,525

Articles.	1897.		1898.		1899.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton	1,245	\$33,800	1,270	\$33,800	230	\$19,200
Lumber, timber, and cord wood	40,000	80,000	80,000	160,000	108,000	216,000
Rice and rice flour	110	5,000	110	6,250		
Miscellaneous	215	4,000	188	4,000	40	1,000
Total	41,570	122,800	81,568	204,050	108,270	236,200
INWARD FREIGHTS.						
Miscellaneous	2,200	80,000	2,000	70,000	900	36,000
Grand total	43,770	202,800	83,568	274,050	109,170	272,200

Articles.	1900.	
	Tons.	Value.
OUTWARD FREIGHTS.		
Timber	93,000	\$137,000
INWARD FREIGHTS.		
Merchandise	24	18,000
Grand total	93,024	155,000

Of the commerce stated above for 1898 and 1899 only the item of timber was carried by river, the remaining items having been hauled away from the river and shipped by rail.

One new transportation line was established, consisting of two small steamers for furnishing supplies to logging camps.

List of vessels plying on Wateree River, South Carolina, during calendar year 1900.

Name.	Character.	Length.	Breadth.	Depth.	Draft, loaded.	Gross tonnage.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	
Janie	Screw tug	42.8	10.5	4.5	.....	17
Otto	do	31.3	11.2	3.7	.....	10

M 8.

IMPROVEMENT OF CONGAREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 1140, annual report for 1885. For map of river see page 1194, annual report for 1889. For project and estimate for lock and movable dam at Granby see page 1184, annual report for 1896.

WORK OF PAST YEAR.

No work was done during the year and no money expended. Previous expenditures for maintenance of the improvement, about \$11,150, should properly be added to the amount given in money statement below as estimated amount required to complete the project. As soon as funds are available it is proposed to make a survey of the shoals requiring improvement, in order to ascertain their present condition, with a view to revision, if found necessary, of the estimate for completing the project. If the lock and dam now under construction at Granby is to be utilized when completed, it is essential that the shoals below Granby be first removed to the project depth of 4 feet at low water. To remove these by the time of completion of the lock and dam will require larger appropriations than have heretofore been made for this work.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1900, nothing.

Money statement.

July 1, 1900, balance unexpended	\$326. 18
July 1, 1901, balance unexpended	326. 18
Amount (estimated) required for completion of existing project	23,500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$14,000. 00
For maintenance of improvement	3,500. 00
	17,500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

For this improvement the following appropriations have been made:

By act of Congress—

Approved August 5, 1886	\$7,500
Of August 11, 1888	7,500
Approved September 19, 1890	5,000
Approved July 13, 1892	5,000
Of August 18, 1894	4,000
Passed June 3, 1896	2,000

Total 31,000

Total expenditures, including June 30, 1901, \$30,673.82.

COMMERCIAL STATISTICS.

Receipts and shipments.

Articles.	1891.		1892.		1893.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores.....	1,476	\$15,840	2,773	\$24,025	1,350	\$16,750
Cotton.....	25	5,000	313	8,000	556	12,875
Miscellaneous.....					75	1,500
Total.....	1,501	20,840	3,086	32,025	1,981	31,125
INWARD FREIGHTS.						
Miscellaneous.....	900	27,000	600	30,000	800	40,000
Grand total.....	2,401	47,840	3,686	62,025	2,781	71,125

Articles.	1894.		1895.		1896.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores.....	274	\$5,260	350	\$2,500	610	\$14,750
Cotton.....			443	13,200	125	20,000
Lumber, timber, and cord wood.....			8,000	20,000	14,637	33,600
Miscellaneous.....	7,500	25,500			735	15,550
Total.....	7,774	30,760	8,793	35,700	16,107	83,900
INWARD FREIGHTS.						
Miscellaneous.....	200	10,000	200	10,000	2,200	95,000
Grand total.....	7,974	40,760	8,993	45,700	18,307	178,900

Articles.	1897.		1898.		1899.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Naval stores.....	240	\$5,000	400	\$7,000		
Cotton.....	20	3,000	475	16,000	270	\$10,400
Lumber, timber, and cord wood.....	40,100	83,200	80,000	160,000	88,000	176,000
Miscellaneous.....	97	1,900	87	1,700	425	5,300
Total.....	40,457	93,100	80,962	184,700	88,696	191,700
INWARD FREIGHTS.						
Miscellaneous.....	400	17,000	400	17,000		
Grand total.....	40,857	110,100	81,362	201,700	88,696	191,700

Articles.	1900.	
	Tons.	Value.
OUTWARD FREIGHTS.		
Timber.....	121,333	\$177,000
INWARD FREIGHTS.		
General merchandise.....	30	20,000
Grand total.....	121,363	197,000

Of the commerce stated above for 1898 and 1899, only the item of timber was carried by water, the remaining items having been hauled away from the river and shipped by rail.

One new transportation line has been established, consisting of two small steamers, for furnishing supplies to logging camps.

List of vessels plying on Congaree River, South Carolina, during the calendar year 1900.

Name.	Character.	Length.	Breadth.	Depth.	Draft, loaded.	Gross tonnage.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	
Janie	Screw tug	42.8	10.5	4.5	-----	17
Otto.....	do.....	31.3	11.2	3.7	-----	10

M 9.

IMPROVEMENT OF CONGAREE RIVER, SOUTH CAROLINA, FROM GERVAS STREET BRIDGE, COLUMBIA, TO GRANBY.

REFERENCE TO PAST REPORTS.

For original project and estimate, see annual report for 1896, pages 1182-1189. For operations to June 30, 1900, see annual report for 1899, page 1542, and for 1900, pages 1864-1867.

WORK OF PAST YEAR.

Work under the contract, approved May 16, 1900, with Mr. George W. Waring, of Columbia, S. C., for the construction of a lock keeper's house and other necessary buildings was completed in September.

Proposals for constructing the lock and the abutment for the dam were opened August 23; and a contract for the work, with the Evansville Contract Company, of Evansville, Ind., the lowest bidder, was approved October 20. The amount of the contract, on the basis of estimated quantities, is \$77,621, and the contract time of completion, January 30, 1902. Work under this contract was begun November 20, and has since been in progress, but with numerous interruptions due to freshets. The cofferdam is now about five-sixths completed, considerable grading has been done, and most of the plant needed for mixing concrete, handling rock, and pumping out cofferdam had been installed.

A portion of the irons needed for the lock had been purchased and stored. Plans for steel lock gates had been prepared and approved and proposals for furnishing the necessary steel were opened June 29.

A topographical survey of both banks of the river was made in November and December from the lock site to the Gervais Street Bridge to determine limits of overflow. Cross sections of the site at 5-foot intervals were taken before work was begun by the Evansville Contract Company. Four current measurements, at different stages of the river, were made.

For details of the work reference is made to the appended report of Assistant Engineer W. A. Leland, who has been in local charge throughout the year.

The sundry civil act approved March 3, 1901, contains the following item:

Improving Congaree River, South Carolina: For continuing improvement from Gervais Street Bridge, Columbia, to Granby, fifty thousand dollars.

Money statement.

July 1, 1900, balance unexpended	\$145, 088. 30
Amount appropriated by sundry civil act approved March 3, 1901	50, 000. 00
June 30, 1901, amount expended during fiscal year	195, 088. 30
July 1, 1901, balance unexpended	183, 742. 47
July 1, 1901, outstanding liabilities	665. 56
July 1, 1901, balance available	183, 076. 91
July 1, 1901, amount covered by uncompleted contracts.....	76, 410. 87
{ Amount (estimated) required for completion of existing project.....	50, 000. 00
{ Amount that can be profitably expended in fiscal year end- ing June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$50, 000. 00
For maintenance of improvement	4, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	54, 000. 00

Amount and date of all appropriations for this work are as follows:

By act of Congress—	
Approved March 3, 1899.....	\$50, 000
Approved June 6, 1900.....	100, 000
Approved March 3, 1901.....	50, 000
Total	200, 000
Total expenditures to June 30, 1901, \$16, 257. 53.	

List of contracts in force.

Contract for—	Name of contractor.	Date of ap- proval.	Date of be- ginning.	Date of com- pletion.
Lock keepers house and other buildings.....	Geo. W. Waring.....	May 16, 1900	May 26, 1900	Sept. 26, 1900
Lock and abutment	Evansville Contract Co	Oct. 20, 1900	Nov. 29, 1900	Jan. 30, 1902

REPORT OF MR. W. A. LELAND, ASSISTANT ENGINEER.

COLUMBIA, S. C., June 29, 1901.

CAPTAIN: I have the honor to submit the following annual report of the work done on Congaree River, between Gervais Street Bridge, Columbia, S. C., and Granby.

The Evansville Contract Company started work on their contract to construct a lock and abutment November 20, 1900, and work was carried on continuously to date. The principal work of the year was building the cofferdam around site of proposed lock and installing plant for mixing concrete and handling rock.

COFFERDAM.

No special style of coffer is called for in specifications. Contractors are required to build a coffer of such strength and tightness as to thoroughly protect the works which

they surround, and the price of same is to be included in the price per unit of concrete, excavations, etc.

The style selected by contractors as best adapted to the local conditions is about as follows: Two parallel lines of stringers, spaced 12 feet across stream, are connected together with bolts. This line of stringers is submerged and kept about 3 feet from the bottom of the river. Immediately above these is placed another tier of stringers, which are kept about 2 feet above low water. Two-inch plank, placed in touch with the upper and lower stringers, are driven to bed rock and spiked to the upper tier of stringers. The space between the two tiers of plank is filled with earth, planked over at top, and weighted down with rock.

Construction of coffer started December 10, 1900, and on March 25, 1901, was within three days of completion when river rose 13 feet above top of coffer, carrying away about 40 feet and washing out most of the filling along entire line. This was the first of six freshets, rising from 10 to 15 feet above top of coffer, with just enough interval between rises to allow for repairs and very little extension of coffer.

The material used at first for filling in between the outer and inner walls of coffer was the sand, loam, and clay mixture obtained at root of coffer. This was easily washed out by freshets, and, after filling in the washouts three times with the same material, the contractors decided to use red clay obtained from a hill about 500 feet from bank. This has held well. About 600 feet of cofferdam will be necessary to surround the lock site. About 500 feet of this has been completed.

PLANT.

The permanent cement shed has been located on top of a hill about 300 feet from the lock. A spur track has been built from the Seaboard Air Line Railroad at Cayce station to this shed. The stone crusher has been located just across the track from the cement shed. Crushed stone will be elevated by belt and buckets to a rotary screen above the stone bins. These bins are provided at bottom with trap doors that discharge the stone through chutes to the mixer cars. A cubical concrete mixer of 125 cubic feet capacity is located between the cement shed and the lock. Sand will be loaded on flat boats from a shoal about 4 miles below the lock, towed by a small steamer to the site, and brought from the flats to sand platform in front of cement shed by cars operated on an incline. The supply cars will first take the charge of sand, then cement, and lastly rock, will be shoved by hand to top of mixer, and dumped into a movable hopper over mixer door. Concrete cars will run direct from mixer along wing wall of lock to main lock, where a turntable will be provided. The track for concrete cars will be on a trestle independent of the framing but near enough to it to dump into the wall without touching the casing. Steam for running the crusher, pumps, and mixing engine is obtained from two 40-horsepower boilers connected together near the crusher. Most of this plant is installed and ready for work.

Two derricks are erected on the shore opposite the lock to hoist out the rock blasted from rock site. These are operated by two independent hoisting engines. A hoisting engine and derrick are located at the site of the abutment, but the derrick has not yet been raised.

The following additional work has been done by contractors:

	Cubic yards.	Price per cubic yard.	Total.
Earth excavation	1,304	\$0.44	\$573.76
Embankment	743	.59	438.37
Rock excavation	50	3.96	198.00

CEMENT.

The contractors submitted samples of Atlas, Lehigh, and Dragon cements for test. No exhaustive tests were made of the two last-named brands, as this office was notified shortly after samples were received that contract had been closed with the Atlas Cement Company, subject to our specifications. A number of tests were made from sample barrels of Atlas cement sent from the factory and from the lot stored at Port Royal, and the cement has so far come up to the requirements.

IRONS FOR LOCK.

Plans were made for the hollow iron quoins, valve frames, line hooks, ladders, snubbing posts, pivots, pivot plates, gate anchorages, crib-line hook boxes, and gate-yoke boxes. These were advertised for in small lots on ten-day proposals and have been received and stored.

LOCK GATES.

Plans were made for steel lock gates with heel and miter posts. The horizontal members are steel-built beams. The upstream face is curved and the downstream face straight. These beams are spaced so that each takes less than the load it can safely carry. Sheathing is three-eighths inch steel plates, riveted to beams and posts.

The members composing these gates were advertised for on May 29 and bids were opened June 29, 1901.

SURVEYS.

A topographical survey of both banks of the river from lock site to Gervais Street Bridge, a distance of $1\frac{1}{2}$ miles, was made in November and December, 1900. A line of levels was run from the zero of the Weather Bureau gauge at pier No. 3, Gervais Street Bridge, and intermediate bench marks established on both banks of the river between this bridge and the lock site. These levels checked on a previously established bench mark at lock site within 0.007 of a foot. The basis of the topographical survey was a line of stakes on either side of the river put in with transit and steel tape. This line started at lock site and followed up the west bank of river to and across Gervais Street Bridge, and down east side of river to abutment site and across to starting point. Notes were platted by latitude and departure, using the southwest corner of Government lot on west side of river as origin of coordinates. The error of closure was one-half foot in latitude and the same in departure. Topography was filled in by the stadia method, using the located stakes as starting and checking points. Levels were run and contours located from low-water line in river to the contour 20 feet above low water. Observations were taken on Polaris for true meridian, and notes of survey were referred to this meridian.

Previous to commencement of work by contractors the area covered by the lock, wing walls, embankment, etc., was divided into cross sections, spaced 5 feet apart, and soundings and levels were taken on these lines about every 5 feet. Current measurements at stages from 2 to 8 feet above low water were taken, and summary is given below:

Gauge reading.	Mean velocity.	Discharge.
	<i>Ft. per sec.</i>	<i>Cu. ft. per sec.</i>
2 feet.....	2.72	8,460
4 feet.....	3.03	12,810
5.9 feet.....	3.21	16,525
8 feet.....	3.30	19,761

These measurements were taken in the following manner: A portion of the river was selected where the bottom was very nearly uniform. A characteristic section of the bottom was obtained by sounding with graduated pole. A small rope was stretched across the river just above the section selected, and tightened so as to clear the water. Tags were put on this rope every 25 feet until opposite bank was reached. A pole, leveled so as to just clear the bottom of the river, was started at each of these tags in succession. An observer, stationed about 20 feet downstream from the line, called the time that poles passed his range to another observer stationed 100 feet farther downstream. The lower observer noted the time when they crossed his range, and the elapsed time and the known section of the river gave the necessary data for determining the mean velocity and discharge.

Very respectfully, your obedient servant,

W. A. LELAND, *Assistant Engineer.*

Capt. J. C. SANFORD,
Corps of Engineers, U. S. A.

M 10.

IMPROVEMENT OF HARBOR AT CHARLESTON, INCLUDING SULLIVAN ISLAND AND MOUNT PLEASANT SHORE, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For history of operations to June 30, 1888, see page 970, annual report for 1888. For modified project, including estimates, see page 1150, annual report for 1889. For full history of all operations up to and including the completion of the jetties, with full discussion of the projects and costs, see page 1189, annual report for 1896. For project for securing a depth of 26 feet at low water from the ocean to deep water inside the harbor, see pages 1551-1557, annual report for 1899.

WORK OF PAST YEAR.

No stone work was done.

The sea-going suction dredge *Charleston* has continued work throughout the year, except when laid up for current repairs, and has removed and dumped 287,206 cubic yards of material. During the greater part of the year she has worked on the new range across the outer bar, now known as the "Eastern channel," referred to in my last annual report and on which between May 1 and June 30, 1900, she had increased the depth from 15.9 to 19.2 feet at mean low water. During the year the depths and widths in this channel have constantly increased, no deterioration having at any time been shown by the frequent surveys that have been made there. The present least depth is 24 feet at mean low water. The material removed is soft mud, much of which does not settle in the bins but is carried out with the overflow; and, while the dredge removed and dumped from this channel only 150,895 cubic yards, it is certain, from the depths and widths gained and from the character of the material, that a much larger quantity was in fact removed. She also removed from the old or southeast channel across the outer bar 35,745 cubic yards, to ease the turn around the "North Breaker." About 19 feet at mean low water can now be carried through this channel. Dredging was continued, the work being done mostly during stormy weather, through the shoal which obstructed the entrance to the jetty channel at its inner end. This has been deepened to 24 feet, widened and straightened, and since May 6 has been lighted by range lights. A small shoal in the jetty channel proper was also dredged to 24 feet. From this and the inner shoal just mentioned 100,566 cubic yards were removed. In consequence of the above work there is now an available depth of 24 feet at mean low water from Charleston to the ocean. Numerous partial surveys have been made as well as a complete survey of the jetty channel and its approaches, a map of which accompanies this report. For a detailed account of the year's dredging work and the results of surveys reference is made to the appended report of Assistant Engineer James P. Allen.

The river and harbor act approved March 3, 1899, authorized the construction of a large sea-going dredge at a cost not exceeding \$150,000, to be used toward obtaining a channel 26 feet deep at mean low water from Charleston to the ocean, under the project submitted November 18, 1898, referred to above. At the opening of bids for

this work August 28, 1899, only one bid was received and this was excessive. Prices of materials and labor having fallen, authority was granted July 7, 1900, to prepare new plans and specifications and to readvertise the work under the modified plans. Bids were opened November 27, 1900, and a contract was approved January 15, 1901, with the Petersburg Iron Works Company of Petersburg, Va., for the construction of the dredge, at a cost of \$144,300, the contract time of completion being November 24, 1901.

At the end of the year about 13 per cent of the hull had been completed, but no work had been done on the propelling or pumping machinery.

The above-mentioned 26-foot project provides for obtaining the proposed channel by the operation of the *Charleston* and the large dredge now under construction. Funds are respectfully asked for the operation of both of these dredges. This dredging, down to a depth of 21 feet, might properly be considered as falling within the former 21-foot project, as in order to secure a permanent, deep, straight channel through the shoal in front of the jetty entrance, formed of material carried out from the jetty channel, mostly during and just after the construction of the jetties, it will be necessary to cut this shoal down from its present height of 10.6 feet below low water (see appended map). Of the amount authorized by the river and harbor act approved July 13, 1892, to be appropriated for the 21-foot project, there still remains to be appropriated \$208,000.

Charleston is a port of entry. Amount of duties collected in the calendar year 1900, \$48,064.21.

Money statements.

26-FOOT PROJECT.

July 1, 1900, balance unexpended.....	\$175,000.00
June 30, 1901, amount expended during fiscal year.....	2,387.14
July 1, 1901, balance unexpended.....	172,612.86
July 1, 1901, amount covered by uncompleted contracts.....	144,300.00
(Amount (estimated) required for completion of existing project.....	110,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	45,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

21-FOOT PROJECT.

July 1, 1900, balance unexpended.....	¹ \$49,010.18
June 30, 1901, amount expended during fiscal year.....	31,865.53
July 1, 1901, balance unexpended.....	17,144.65
July 1, 1901, outstanding liabilities.....	2,467.34
July 1, 1901, balance available.....	14,677.31
(Amount (estimated) required for completion of existing project.....	208,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
{ For works of improvement.....	\$30,000.00
{ For maintenance of improvement.....	25,000.00
	55,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

¹ Balance stated in annual report for 1900 as unexpended, was too large by \$0.53, the amount of Auditor's settlements Nos. 11941 and 11944 aggregating \$0.53.

For this improvement the following appropriations have been made:

By act of Congress—

Approved June 18, 1878..	\$200,000
Approved March 3, 1879 ..	200,000
Approved June 14, 1880 ..	170,000
Approved March 3, 1881 ..	175,000
Passed August 2, 1882.....	300,000
Approved July 5, 1884	250,000
Approved August 5, 1886..	187,500
Of August 11, 1888.....	350,000

By act of Congress—

Approved Sept. 19, 1890 ..	\$370,000
Approved July 13, 1892 ..	225,000
Approved March 3, 1893..	750,000
Approved August 18, 1894	450,000
Approved March 2, 1895 ..	500,000
Approved June 6, 1900....	220,000
Total	4,347,500

Total expenditures to June 30, 1901, \$4, 157, 742. 49.

List of contracts in force.

Contract for—	Name of contractor.	Date of approval.	Date of beginning.	Date of completion.
Constructing sea-going suction dredge complete.	Petersburg Iron Works Co....	Jan. 15, 1901..	Jan. 31, 1901 ..	Nov. 24, 1901

COMMERCIAL STATISTICS.

[Does not include trade between Charleston and other points in same collection districts.]

Arrivals and clearances of vessels and commerce at Charleston, S. C., from January 1, 1875, to December 31, 1899.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875	504	382,018	11,949	38	13,144	326	198	88,879	2,404	740	484,041	14,379
1876	471	340,439	10,113	44	11,898	335	224	101,272	2,768	739	453,609	13,216
1877	400	324,919	9,885	32	13,972	308	336	105,480	2,851	668	444,371	13,044
1878	396	322,527	9,623	44	19,935	455	329	163,368	3,967	772	505,830	14,045
1879	383	326,681	10,027	39	12,505	319	249	121,503	3,292	668	460,659	13,638
1880	441	388,026	20,641	38	12,412	327	191	110,771	2,595	670	511,209	13,563
1881	412	399,732	10,377	34	9,430	272	257	121,077	3,073	703	530,239	13,722
1882	410	384,690	9,446	35	4,807	224	200	105,647	2,648	645	495,144	12,318
1883	345	277,538	7,629	26	3,002	157	239	113,768	2,958	610	394,308	10,744
1884	425	304,382	9,822	21	3,910	145	214	134,076	3,269	690	442,368	13,236
1885	375	268,477	9,637	15	2,344	97	187	106,233	2,586	577	377,054	12,320
1886	901	550,209	.....	20	3,714	131	182	114,507	2,646	1,103	668,403	.....
1887	927	656,949	.....	30	7,074	199	127	67,257	1,607	1,084	731,280	.....
1888	a 924	601,771	.....	34	7,750	252	127	72,921	1,779	1,085	682,442	.....
1889	b 339	481,718	9,708	30	6,985	216	136	87,101	1,979	496	575,804	11,903
1890	c 410	600,776	13,677	35	7,205	242	120	81,518	1,828	565	689,499	15,745
1891	d 417	680,776	15,695	27	4,665	179	150	119,199	2,383	594	804,640	18,257
1892	e 388	625,880	14,705	28	5,138	193	87	69,091	1,416	503	700,109	16,314
1893	f 338	566,923	13,106	28	6,622	202	108	92,532	1,970	474	666,077	15,278
1894	g 327	574,423	13,155	22	4,765	137	100	100,213	1,856	449	679,401	15,148
1895	h 369	625,121	14,328	21	5,569	197	57	51,666	999	447	682,356	15,241
1896	i 333	583,438	14,251	22	7,058	170	74	75,564	1,390	429	666,060	15,811
1897	j 458	782,081	19,135	10	3,495	125	107	133,486	2,267	575	919,012	21,527
1898	k 420	708,175	16,740	14	9,347	251	91	109,043	2,000	525	826,565	18,991
1899	l 403	728,917	18,632	21	15,417	499	82	95,224	1,680	506	839,558	20,811
1900	m 425	749,419	19,159	4	1,428	32	74	99,182	1,490	503	850,029	20,681

a Of these, 32 vessels (tonnage, 31,035), with crews numbering 608, were foreign.

b Of these, 29 vessels (tonnage, 9,440), with crews numbering 546, were foreign.

c Of these, 58 vessels (tonnage, 55,533), with crews numbering 1,110, were foreign.

d Of these, 34 vessels (tonnage, 39,078), with crews numbering 717, were foreign.

e Of these, 31 vessels (tonnage, 30,949), with crews numbering 562, were foreign.

f Of these, 31 vessels (tonnage, 36,156), with crews numbering 633, were foreign.

g Of these, 9 vessels (tonnage, 12,025), with crews numbering 212, were foreign.

h Of these, 22 vessels (tonnage, 20,936), with crews numbering 487, were foreign.

i Of these, 15 vessels (tonnage, 24,399), with crews numbering 386, were foreign.

j Of these, 4 vessels (tonnage, 6,327), with crews numbering 114, were foreign.

k Of these, 10 vessels (tonnage, 14,345), with crews numbering 237, were foreign.

l Of these, 10 vessels (tonnage, 17,910), with crews numbering 313, were foreign.

m Of these, 10 vessels (tonnage, 19,522), with crews numbering 248, were foreign.

Arrivals and clearances of vessels and commerce at Charleston, S. C., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.									Total.		
				American vessels.			Foreign vessels.								
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.			
1875	461	328,266	10,830	57	24,679	555	211	94,595	2,527	729	447,540	13,912			
1876	431	278,744	9,095	60	23,598	546	230	103,276	2,812	721	405,618	12,453			
1877	335	234,429	7,719	35	22,767	423	250	108,446	2,910	620	365,662	11,052			
1878	266	172,988	5,801	45	24,397	479	398	149,975	3,591	509	347,360	14,045			
1879	287	188,212	6,268	34	11,282	292	278	149,052	3,643	599	348,546	10,203			
1880	296	190,733	6,348	45	23,210	481	246	155,768	3,375	587	369,711	10,204			
1881	268	187,569	5,942	32	9,239	255	278	153,796	3,464	578	350,604	9,661			
1882	147	113,699	3,690	40	7,375	273	263	158,250	3,584	450	379,324	7,546			
1883	98	48,714	2,018	27	4,560	181	299	154,653	3,815	424	207,927	6,014			
1884	212	116,020	4,555	31	7,845	217	276	161,588	3,727	519	285,453	8,499			
1885	191	99,658	5,047	24	5,217	164	204	119,602	2,836	419	224,467	8,047			
1886	890	543,259	-----	25	5,469	165	201	126,943	2,875	1,116	675,671	-----			
1887	888	610,646	-----	28	5,837	189	173	115,218	2,546	1,089	731,701	-----			
1888	a 911	580,468	-----	30	5,848	211	144	96,146	2,105	1,085	682,462	-----			
1889	b 46	358,596	778	25	5,080	174	165	112,037	2,495	236	155,713	3,467			
1890	c 21	12,863	292	41	10,161	318	166	126,078	2,676	228	149,102	3,286			
1891	d 39	21,197	436	32	6,887	216	164	143,398	2,809	255	171,482	3,461			
1892	e 26	29,752	565	28	5,760	197	111	89,390	1,798	165	124,902	2,560			
1893	f 49	47,756	978	29	5,761	198	100	88,421	1,671	178	141,938	2,847			
1894	g 46	36,760	723	22	5,422	152	90	97,769	1,715	158	139,951	2,590			
1895	h 84	86,420	1,915	13	2,283	96	72	81,420	1,331	169	170,123	3,342			
1896	i 69	90,106	1,882	8	1,487	51	67	74,216	1,343	144	165,809	3,276			
1897	j 96	106,359	1,879	7	1,364	49	77	88,405	1,538	180	196,128	3,466			
1898	k 63	74,803	1,435	7	3,518	116	79	92,272	1,768	149	170,593	3,319			
1899	l 86	114,924	2,190	7	10,139	304	49	53,745	986	142	178,808	3,480			
1900	m 69	92,611	1,474	3	566	23	41	49,455	830	113	142,632	2,327			

a Of these, 7 vessels (tonnage, 4,295), with crews numbering 62, were foreign.

b Of these, 4 vessels (tonnage, 2,960), with crews numbering 47, were foreign.

c Of these, 7 vessels (tonnage, 6,186), with crews numbering 135, were foreign.

d Of these, 18 vessels (tonnage, 16,332), with crews numbering 303, were foreign.

e Of these, 13 vessels (tonnage, 15,068), with crews numbering 261, were foreign.

f Of these, 29 vessels (tonnage, 31,810), with crews numbering 554, were foreign.

g Of these, 19 vessels (tonnage, 15,795), with crews numbering 292, were foreign.

h Of these, 11 vessels (tonnage, 10,325), with crews numbering 222, were foreign.

i Of these, 18 vessels (tonnage, 22,047), with crews numbering 363, were foreign.

j Of these, 40 vessels (tonnage, 58,108), with crews numbering 994, were foreign.

k Of these, 22 vessels (tonnage, 30,941), with crews numbering 505, were foreign.

l Of these, 43 vessels (tonnage, 60,243), with crews numbering 951, were foreign.

m Of these, 12 vessels (tonnage, 73,293), with crews numbering 1,057, were foreign.

Coastwise vessels are not required to enter or clear.

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.	Year.	Value of exports.	Value of imports.	Duties collected.
1875	\$19,655,966	\$680,343	\$80,656.00	1888	\$13,006,578	\$625,770	\$76,398.00
1876	18,088,152	455,562	89,168.00	1889	16,080,255	664,696	16,728.82
1877	16,917,492	161,237	46,848.00	1890	15,204,771	836,626	18,356.81
1878	21,167,575	184,127	36,990.00	1891	21,906,076	1,204,588	24,308.47
1879	18,693,126	127,981	24,070.00	1892	11,460,681	368,926	15,494.24
1880	24,939,259	248,158	46,453.98	1893	11,056,287	883,842	16,689.75
1881	21,927,269	723,049	99,066.23	1894	10,877,048	683,324	28,423.01
1882	19,907,099	459,970	45,263.33	1895	10,063,605	522,721	31,370.26
1883	20,144,365	467,648	48,760.69	1896	11,144,669	641,177	19,997.81
1884	20,833,424	503,504	36,624.76	1897	10,807,728	1,299,035	76,802.23
1885	15,157,889	588,191	32,741.68	1898	9,768,326	1,187,924	139,226.63
1886	17,410,000	635,000	24,876.00	1899	5,305,166	1,080,002	76,359.61
1887	15,288,316	484,063	30,817.00	1900	9,788,552	1,382,358	48,064.21

REPORT OF ASSISTANT ENGINEER JAMES P. ALLEN.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., June 30, 1901.

CAPTAIN: I have the honor to submit the following annual report, describing the surveys at Charleston Harbor for the fiscal year ending June 30, 1901.

A survey of the inner shoal, having reference to the work of widening the inner

end of the dredged channel and of facilitating navigation at this point, and also to the location of the new lighted range, was made November 28 and December 6, 1900. Surveys of the new or eastern entrance channel were made August 13, September 14-17, December 31, and again January-February, 1901; besides which, soundings were frequently taken by the dredge *Charleston* during the progress of her work in this channel. The area beyond the ends of the jetties was surveyed December 31, 1900, to furnish information for the Naval Station Board, and again in January-February, 1901, including the eastern channel, as already stated.

Finally, an extensive and thorough survey, covering all of the above localities and also the area between the jetties, was made between April 26 and June 25, 1901. A copy of the chart made from this last is submitted herewith for publication with your annual report for Charleston Harbor.

All of the soundings on this chart were taken within the two months stated, and most of them in the month of May.

Following the general plan of my report to you of last year, the work of the dredge *Charleston* will be described first, inasmuch as this may aid in explaining changes shown between the surveys of 1900 and 1901.

The dredge *Charleston* has worked very steadily during the year. She lost 26 days in general repairs and in delays connected therewith. Other delays due to repairs have not caused the loss of more than a few days at a time, nor has such loss of time aggregated many days in the year. The outer dredging has been mainly in the new or eastern channel. Some material has been removed from the shoalest part of the old entrance channel and from the foot of the shoal lying to the north and east of this channel. On the inner shoal the work has been mainly directed toward widening and deepening the entrance into the dredged channel from the inside. A new range was established by the United States Light-House Establishment to facilitate navigating this channel at its inner end. This was lighted first on May 6, and is shown upon the chart. At one point near the new range a lump was shown by one of the surveys with less than 24 feet at mean low water. This lump was removed. At another point on the main range, St. Philip's spire and the light on Fort Sumter, there was less than 24 feet. This was also deepened to 24 feet and over. The following quantities have been removed:

	Cubic yards.
From the inner shoal.....	100,566
From the outer shoal (eastern channel).....	150,895
From the outer shoal (old channel).....	35,745
Total.....	287,206

This very marked falling off in the number of cubic yards removed and dumped as compared with former years is largely due to the character of the material in the eastern channel. This proved to be mud, very soft as it came into the bins, so that it settled slowly. Probably at times 50 per cent of the dredged material was lost in the overflow. The result of the dredging in this eastern channel, as measured by the increase of depth, is very satisfactory. It would seem that much of the material going overboard with the overflow is not redeposited in the channel, but is carried off by currents.

As compared with the annual survey of 1900, the recent survey indicates the following:

On the inner shoal, one of the two lumps of less than 18 feet, which was shown last year to the north of the old range (St. Philip's and Sumter light), has disappeared, and the other is much smaller. The area within the 21-foot curve is also smaller. There is decided increase of the deep-water area, as defined by the 26-foot curve. The channel lines defining the width of the channel have not changed materially until a point near the ends of the jetties is reached. The area between the channel and the north jetty shows no marked change inside of the jetties. The area between the channel and the south jetty shows some shoaling near the outer end, but none elsewhere. But little change is shown here when comparison is made with the survey next preceding that of last year, viz, that of 1897. North of the channel and near the ends of the jetties increase of depth is shown, due to a very decided outward movement of the material, which causes corresponding shoaling just at the ends. The outer shoals have moved seaward, as heretofore, that to the south of the Fort Sumter range rather more than that to the north of this range, as judged by the 18-foot curves. The lump of less than 12 feet in the north shoal has moved seaward about 600 feet. The outer 26-foot curve shows a decided outward movement. The area of over 26 feet along the line of the old channel has increased, and the deep water has projected itself seaward about 600 feet.

The increase of depth and width in the new or eastern channel is very marked. The width between 21-foot curves at the narrowest point is about 150 feet. Between

SULLIVAN ISLAND

High water 10.5
Low water 10.0

LOW WATER DEPTHS IN JETTY CHANNEL CHARLESTON S. C.

SCALE OF FEET

Notes
Soundings are in fathoms unless otherwise noted.
The chart is based on the survey of 1880.
The chart is based on the survey of 1880.
The chart is based on the survey of 1880.

Accompanying annual report to 1904
John J. Ford
Captain of Engineers

the 18-foot curves the available width is about 500 feet. The withdrawal of the shoal on the north side of this channel, as outlined by the 18-foot curve, is due largely to dredging. It is a favorable indication of the continuance of this channel that the dredge was able to make so much of an impression upon the foot of this shoal. Fears were expressed in my last annual report that this channel would quickly fill in a heavy storm.

There is shown a central depth of not less than 24 feet at mean low water entirely through from the harbor to the sea.

The soundings have been reduced to the plane of mean low water used for many years. It was shown last year that this plane was 0.27 foot too low at the outer gauge.

Two automatic tide gauges have been run throughout the year, one at Fort Sumter and one at the custom-house wharf in Charleston. The outer gauge was lost in a storm on November 25, 1900.

Very respectfully, your obedient servant,

JAMES P. ALLEN,
Assistant Engineer.

Capt. J. C. SANFORD, *Corps of Engineers.*

M II.

IMPROVEMENT OF WAPPOO CUT, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For original project see annual report for 1881, page 1073. For present project see annual report for 1889, page 1196. For map of Wappoo cut see annual report for 1891, page 1476.

WORK OF PAST YEAR.

A thorough survey was made in January of the improved portions of the cut proper and of the Ashley River and Stone River entrances. The survey showed a 6-foot channel at mean low water through the cut, with a width of not less than 60 feet, except at one point. Across the Ashley River bar there was found a central depth of 7 feet and a 6-foot channel about 150 feet wide. In February a narrow portion of the cut proper was redredged, using Government plant, to full width, 2,770 cubic yards of material being removed. To guide across the Ashley River bar, two day marks were put up in the marsh.

Of the expenditures of the year, \$1,084.93 is chargeable to maintenance. This amount, together with previous expenditures for maintenance, about \$1,925.43, should properly be added to the amount given in money statement below as estimated amount required to complete the project.

This cut, although not yet completed, has proved of great value to the trade of Charleston and that of the whole South Carolina coast south of Charleston.

The cut is tributary to the collection district of Charleston, S. C. Charleston is its port of entry. Amount of duties collected in the calendar year 1900, \$48,064.21.

Money statement.

July 1, 1900, balance unexpended	\$1, 283. 91
June 30, 1901, amount expended during fiscal year	1, 283. 91

Amount (estimated) required for completion of existing project	25, 500. 00
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Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended	
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July 1, 1901:	
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For works of improvement.....	\$15, 000. 00
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For maintenance of improvement.....	3, 000. 00
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	18, 000. 00
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Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

For this improvement the following appropriations have been made:

By act of Congress—		By act of Congress—	
Approved March 3, 1881	\$10,000	Approved July 13, 1892	\$10,000
Passed August 2, 1882	10,000	Of August 18, 1894	7,000
Approved July 5, 1884	3,000	Passed June 3, 1896	2,500
Approved August 5, 1886	5,000		
Of August 11, 1888	5,000	Total	62,500
Approved September 19, 1890	10,000		
Total expenditures, including June 30, 1901, \$62,500.			

COMMERCIAL STATISTICS.

Articles.	1888.		1889.		1891.		1892.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
Fertilizers	62,000	\$330,000	72,500	\$515,000	76,400	\$546,000	68,000	\$337,500
Cotton	937	360,000	1,560	750,000	1,875	800,000	1,560	850,000
Vegetables	7,240	240,000	4,820	125,000	5,427	160,000	5,730	200,000
Rice	2,950	150,000	4,910	262,500	4,728	250,000	7,880	300,000
Lumber	44,650	160,000	50,220	190,000	55,800	200,000	66,960	275,000
Miscellaneous			7,000	25,000	6,000	20,000	50,000	35,000
Total	117,677	1,240,000	141,010	1,867,500	150,230	1,976,000	200,130	1,997,500

Articles.	1893.		1894.		1895.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
Fertilizers	82,800	\$465,500	78,000	\$383,000	83,500	\$360,100
Cotton	780	450,000	600	225,000	950	420,000
Vegetables	7,240	260,000	6,000	250,000	780	265,000
Rice	7,090	350,000	18,750	425,000	10,000	800,000
Lumber	78,120	290,000	80,000	340,000	95,000	350,000
Miscellaneous	60,000	50,000	55,000	60,000	60,000	65,000
Total	236,030	1,865,500	238,350	1,683,000	250,320	2,260,100

Articles.	1896.		1899.		1900.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
Fertilizers	92,000	\$400,000	76,025	\$283,700	30,245	\$213,585
Cotton	1,000	460,000	1,162	509,878	823	503,500
Vegetables	1,200	325,000	5,000	235,000	8,670	392,400
Rice	9,800	780,000	8,643	352,000	7,118	355,914
Lumber	98,000	375,000	65,000	225,117	51,993	156,500
Miscellaneous	70,000	70,000	80,000	400,000	60,000	910,000
Total	272,000	2,410,000	235,830	2,005,695	158,849	2,531,899

Traffic through this cut was carried on by tugboats and steamers of from 40 to 300 tons, small schooners of from 2 to 50 tons, lighters, rafts, etc.

No new line of transportation was established during the year.

M 12.

IMPROVEMENT OF BEAUFORT RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 1235, annual report for 1890.
For reason for increasing estimate see page 1529, annual report for 1893.

WORK OF PAST YEAR.

No dredging was done under the project during the year.

The removal of illegally dumped material referred to in last year's report was continued by the contractor and was completed in December, an inspection of his work being made from time to time.

This river is tributary to the collection district of Beaufort, S. C. Beaufort is its port of entry. Amount of duties collected in the calendar year 1900, none.

Money statement.

July 1, 1900, balance unexpended.....	\$458. 70
June 30, 1901, amount expended during fiscal year.....	47. 50
July 1, 1901, balance unexpended.....	411. 20
July 1, 1901, outstanding liabilities.....	3. 45
July 1, 1901, balance available.....	407. 75
(Amount (estimated) required for completion of existing project.....	9,000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$9,000. 00
For maintenance of improvement.....	2,000. 00
	11,000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

For this improvement the following appropriations have been made:

By act of Congress—	
Approved September 19, 1890.....	\$12, 500
Approved July 13, 1892.....	12, 500
Of August 18, 1894.....	5, 000
Passed June 3, 1896.....	1, 000
Total.....	31, 000
Total expenditures to and including June 30, 1901, \$30,588.80.	

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Beaufort, S. C., from January 1, 1888, to December 31, 1900. (a)

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	103	121, 207	2, 630	3	1, 093	26	30	21, 785	422	136	144, 085	3, 078
1889	98	128, 834	2, 728	2	1, 461	19	58	54, 464	1, 096	158	230, 193	3, 853
1890	43	49, 173	927	7	2, 987	75	52	48, 656	972	102	100, 816	1, 974
1891	37	40, 145	786	3	1, 567	26	22	21, 503	416	62	63, 215	1, 222
1892	29	34, 979	607	1	896	9	37	43, 526	771	67	79, 401	1, 387
1893	40	51, 967	854	4	3, 101	38	36	45, 774	771	80	100, 842	1, 663
1894	29	39, 171	681	3	2, 925	32	41	72, 469	1, 220	73	114, 565	1, 993
1895	35	47, 397	823	1	1, 005	12	30	51, 912	1, 095	66	100, 314	2, 039
1896	18	26, 978	467	2	1, 716	22	33	54, 780	968	53	83, 474	1, 457
1897	11	17, 751	262	3	1, 931	26	25	42, 564	792	39	61, 246	1, 080
1899	15	17, 279	334	2	1, 184	15	24	38, 671	632	41	57, 134	981
1900	10	11, 257	174	.....	.....	.....	13	22, 146	370	23	33, 403	544

CLEARED.

1888.....	57	63, 287	1, 566	3	1, 465	33	78	85, 523	1, 561	138	150, 275	3, 160
1889.....	57	73, 744	1, 872	.....	.....	.....	98	99, 898	1, 944	155	173, 642	3, 816
1890.....	12	6, 436	127	1	101	14	88	94, 285	1, 828	101	100, 822	1, 969
1891.....	7	3, 921	75	.....	.....	.....	51	56, 300	932	58	60, 221	1, 007
1892.....	7	4, 268	92	.....	.....	.....	59	72, 702	1, 264	66	76, 970	1, 356
1893.....	6	6, 313	110	1	296	8	67	92, 248	1, 494	74	98, 857	1, 612
1894.....	5	6, 237	118	1	296	8	60	101, 620	1, 714	66	108, 162	1, 840
1895.....	5	5, 902	89	.....	.....	.....	66	100, 843	1, 929	71	106, 745	2, 018
1896.....	7	8, 913	127	.....	.....	.....	44	73, 656	1, 282	51	82, 519	1, 409
1897.....	3	5, 644	77	.....	.....	.....	33	54, 057	972	39	59, 701	1, 049
1898.....	11	10, 223	161	.....	.....	.....	35	51, 878	879	46	62, 101	1, 040
1900.....	8	13, 307	250	2	1, 034	21	15	23, 227	339	25	37, 568	610

1606 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Arrivals and clearances of vessels and commerce at Beaufort, S. C., etc.—Continued.

Year.	Value of ex-ports.	Value of im-ports.	Duties col-lected.
1888.....	\$850,393.00	\$65,645.36	\$17.00
1889.....	1,083,085.00	24,266.00	160.00
1890.....	1,040,197.00	41,005.00	.....
1891.....	627,851.00	137,942.54	31.50
1892.....	791,554.00	77,751.49	.....
1893.....	2,251,685.50	19,278.31	9.00
1894.....	4,939,417.00	59,054.00	182.00
1895.....	4,155,619.00	70,382.32	1,529.00
1896.....	4,316,259.00	135,482.62	1,490.40
1897.....	2,605,896.00	84,651.07	2,537.37
1899.....	358,886.00	76,098.00	33.70
1900.....	132,561.70	428,896.26	.....

a No report made for 1898.

Statistics for that portion of Beaufort River, South Carolina, known as Brickyard Creek.

Articles.	1891.		1892.		1893.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Phosphate rock.....	173,000	\$820,000	200,000	\$880,000	180,000	\$900,000
Cotton.....	1,600	140,000	11,000	200,000	110	26,000
Lumber, timber, and cord wood.....	10,185	39,800	18,000	55,000	26,640	117,500
Rice and rice flour.....	1,000	50,000	1,000	30,000	.....	.....
Miscellaneous.....	16,450	329,000	20,000	340,000	8,250	137,500
Total.....	202,235	1,378,800	250,000	1,505,000	215,000	1,181,000

Articles.	1894.		1895.		1896.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Phosphate rock.....	150,000	\$525,000	150,000	\$450,000	80,000	\$180,000
Cotton.....	285	42,000	600	153,750	1,217	139,000
Lumber, timber, and cord wood.....	32,000	133,000	12,000	66,000	15,000	52,000
Rice and rice flour.....	700	30,000	700	30,000	800	35,000
Miscellaneous.....	11,000	220,000	11,000	220,000	3,250	182,000
Total.....	193,985	950,000	174,300	919,750	100,267	588,000

Articles.	a 1897.		a 1898.		1899.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
OUTWARD FREIGHTS.						
Phosphate rock.....					100,000	\$300,000
Cotton.....					500	128,000
Lumber, timber, and cord wood.....					2,400	5,000
Miscellaneous.....					11,500	222,000
Total.....					114,400	655,000

Articles.	1900.	
	Tons.	Value.
OUTWARD FREIGHTS.		
Phosphate rock.....	130,225	\$390,675
Cotton.....	510	105,000
Lumber, timber, and cord wood.....	2,500	6,000
Cotton seed.....	600	15,000
Miscellaneous.....	2,800	170,000
Total.....	136,635	686,675

a No report.

Aggregate tonnage, value, and number of trips of vessels passing through that portion of Beaufort River, South Carolina, known as Brickyard Creek, for the year 1900.

Class.	Number.	Aggregate tonnage.	Aggregate value.	Aggregate number trips.
Tugboats	4	280	\$80,000	800
Coastwise	8	400	40,000	200
Pleasure yachts (steam and sail)	27	850	250,000	140
Small boats, 2 to 50 tons	40	500	6,000	500
Wash boats and dredges	8	2,000	150,000	16
Lighters	125	12,000	85,000	9,000
Pilot boats	3	150	15,000	50
Revenue cutters	1	700	175,000	50
Buoy tenders	1			
Passenger boats (steam)	1	400	25,000	100
Total	218	17,280	826,000	9,856

Deepest draft vessels and tonnage for Beaufort River, South Carolina, for the year 1900.

Name.	Number.	Draft.	Tonnage.
		<i>Feet.</i>	
Otoyo	1	23.09	2,339
Ormidale	1	23.06	2,305
Folmina	1	23.09	2,339

No new lines of transportation were established.

M 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Nothing has been done during the year. From the allotment of \$2,000 made April 26, 1900, for the removal of sunken logs, originally forming parts of rafts, from the "inland passage" between Charleston, S. C., and Beaufort, S. C., there remains a balance of \$1,421.05, which it is proposed to apply to the removal of such obstructions of this kind as may be hereafter reported, when their ownership can not be determined, and to securing compliance with the law regarding obstructions.

M 14.

EXAMINATION AND SURVEY OF GREAT PEDEE RIVER, SOUTH CAROLINA.

[Printed in House Doc. No. 124, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 3, 1900.

SIR: I have the honor to submit the accompanying copies of reports dated, respectively, September 15 and November 19, 1900, by Capt. J. C. Sanford, Corps of Engineers, upon preliminary examination and survey made to comply with the provisions of the emergency river and harbor act of June 6, 1900, of Great Pedee River, South Carolina, between Cheraw and the Wilmington, Columbia and Augusta Railroad Bridge.

The plan of improvement presented contemplates obtaining a $3\frac{1}{2}$ -foot channel depth at low water between the limits mentioned in the act, by means of dredging, the removal of snags, logs, and overhanging trees, and the construction of timber and pile dams, all at an estimated cost of \$118,345.37, not including \$4,000 per year for maintenance of the improvement after its completion. It is stated in the report that the estimate of cost of the improvement is based on the assumption that none of the money that may be appropriated for the work of improvement proper shall be spent toward maintenance; that during the progress of the improvement it would be necessary each year to remove the snags, logs, etc., that may get into the channel, and for this purpose \$2,000 per year would be required, in addition to the sums appropriated for improvement.

Captain Sanford is of opinion that the proposed improvement is fully justified by the commercial interests involved, and the division engineer, Col. Peter C. Hains, Corps of Engineers, concurs in such opinion, "provided sufficient funds be furnished to carry on the operations uninterruptedly, and without recourse to maintenance until a $3\frac{1}{2}$ -foot navigation is completed throughout the 64 miles of this portion of the river."

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF GREAT PEDEE RIVER, SOUTH CAROLINA,
BETWEEN CHERAW AND THE WILMINGTON, COLUMBIA AND AUGUSTA
RAILROAD BRIDGE.

PALMYRA, N. Y., *September 15, 1900.*

GENERAL: I have the honor to submit the following report upon a preliminary examination of Great Pedee River, South Carolina, "between Cheraw and the Wilmington, Columbia and Augusta Railroad bridge," as provided for in section 2 of the emergency river and harbor act approved June 6, 1900.

The commercial importance of this river to the State of South Carolina seems to have been early recognized. In 1784 the legislature of the State appropriated £300 for the removal of obstructions, as far up as the North Carolina line, where the name of the river changes and it becomes the Yadkin. Again, in 1785, 1791, 1805, and 1815, acts were passed by the same body either appropriating funds or levying a special land tax for its improvement, or requiring the male inhabitants of the adjacent counties to work six days in the year in removing obstructions. All of this legislation covered the portion of river now under consideration.

The river was first examined for the United States Government in 1873 under Col. Q. A. Gillmore, Corps of Engineers. In October, 1879, a survey was made under Capt. Charles B. Phillips, Corps of Engineers, who submitted a project for the improvement of 172 miles from Cheraw to Georgetown, the cost of which was to be \$25,520. In

1885 this estimate was revised by Maj. W. H. Bixby, Corps of Engineers, who then stated that \$90,000, over and above the \$27,000 already appropriated, would be needed to clear the river of obstructions, so as to secure a thoroughly cleared channel of a depth of at least 9 feet at all stages as far up as Smiths Mills and thence a channel of at least $3\frac{1}{2}$ feet at all stages to Cheraw.

The total amount which has been appropriated for the improvement of the whole river is \$111,500, of which there is still a balance on hand of about \$2,500. These appropriations have been made in small sums from time to time, extending from 1880 to 1899. The project has not been completed, and the funds available have been barely sufficient to keep a channel open for the immediate needs of navigation from Georgetown—103 miles—to the Wilmington, Columbia and Augusta Railroad Bridge.

The distance covered by this examination is about 69 miles. The river has considerable width and in times of freshet carries large quantities of water. At its lowest stages the depth available for navigation is only from 1 to 2 feet on probably twelve shoal places. These shoals are to a great extent formed by accumulations of sand around sunken logs and snags. Generally the water is comparatively deep both above and below the shoals.

The river passes through a productive country yielding mainly corn and cotton. Cheraw is a town of about 1,500 inhabitants, and Society Hill, 17 miles farther down, has from 800 to 1,000.

No attempt has been made to remove or dredge through the shoals of this river. This would be necessary in order to secure a channel of $3\frac{1}{2}$ feet depth to Cheraw. There are also shoals below the Wilmington, Columbia and Augusta Railroad Bridge, on which I am informed the depth is less than $3\frac{1}{2}$ feet at low water. These do not come within the scope of this examination.

Information obtained from an experienced river man seems to indicate that there is now less depth of water in that portion of the river under examination than formerly, due, it is thought, to the accumulation of more sand on the shoals and to the collection of more trees, logs, etc., in the channel, or to the low-water stages of the river being lower during the past few years. The result is that navigation has become more and more difficult and the commerce of this portion of the river has gradually decreased until it is now very inconsiderable. It is stated that formerly 50,000 bales of cotton were shipped annually from landings on the river between Cheraw and the Wilmington, Columbia and Augusta Railroad Bridge. There is at this time practically no annual commerce on the river, except such as is carried on by timber rafts, of which not even an approximate account could be secured.

The prospective commerce is represented by the communities interested in the improvement to be between 300,000 and 400,000 tons, valued at over \$7,000,000.

I regard this portion of Great Pedee River as worthy of improvement. The survey will cost about \$1,500. From this a map of the river and the required estimate can be made. No funds are needed, as the balance on hand will cover all of the expenses of surveying and mapping.

Details of the examination and of prospective commerce are given

in the appended report of Assistant Engineer Reid Whitford with its inclosures.

Very respectfully, your obedient servant,

J. C. SANFORD,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., September 19, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

My opinion is that the Great Pedee River is worthy of improvement to a limited extent; but that the future commerce will reach the figures quoted by the district engineer, by improving the navigation to 3½ feet, I doubt.

In order to determine within a reasonable degree of accuracy the cost of an improvement that the Government would be justified in making, a survey, as suggested by the district engineer, is needed, and I recommend that it be authorized.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 21, 1900.

Respectfully submitted to the Secretary of War.

This is a report upon preliminary examination of Great Pedee River, South Carolina, between Cheraw and the Wilmington, Columbia and Augusta Railroad Bridge, required by the provisions of the emergency river and harbor act of June 6, 1900.

The local engineer is of opinion that this portion of the river is worthy of improvement by the General Government.

Inviting attention to the views of the division engineer, expressed in first indorsement hereon, I recommend that a survey be made, from the results of which an opinion may be formed as to the extent of improvement that may be justified by the commerce involved.

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

[Third indorsement.]

WAR DEPARTMENT,
September 24, 1900.

Approved as recommended by the Chief of Engineers.

NELSON A. MILES,
Acting Secretary of War.

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., September 8, 1900.

CAPTAIN: I have the honor to make the following report on preliminary examination of Great Pedee River, South Carolina, from Cheraw to the Wilmington, Columbia and Augusta Railroad Bridge, to comply with section 2 of the emergency river and harbor act of June 6, 1900, and also in response to your letter of August 22, 1900.

DESCRIPTION AND REMARKS.

The distance between the places mentioned is approximately 69 miles. The river has considerable width and is a bold stream, carrying large quantities of water during the freshet period, but at its dead low stage the channel depth is reduced from 1 to 2 feet on probably 12 shoal places, to a great extent formed by the accumulation of sand around sunken logs and snags. Generally the water is comparatively deep both above and below the shoals.

The country through which the river finds its way is considered the most productive in the State of South Carolina for cotton, corn, etc., large quantities of the above articles being harvested yearly.

The town of Cheraw, situated at the head of navigation, is a place of considerable commercial importance, of about 1,500 people.

Society Hill, 17 miles farther down, located 2 to 3 miles from the river, is also a town of considerable trade, with a population of 800 to 1,000.

The country was looked over generally as to its commercial resources, and a great many people living within reach of the river express themselves as being extremely anxious for the improvement of the stream, to be finally developed into something beneficial to the industries of their country.

The Pedee people are generally alive to the importance of using their river for the economical transportation of products and supplies. They also realize the utter hopelessness of maintaining anything like a steady yearly traffic on the stream in its present condition. The country therefore is left at the mercy of railroad rates for the transportation rates.

HISTORY.

To say that this stream is worthy of improvement would be nothing more than the opinion expressed as far back as the year 1784, when an act of the South Carolina legislature appropriated £300, to be expended in the removal of all obstructions as far up as the North Carolina line; 1785, an act of the same legislature to improve the river from Yauhannah Ferry, 28 miles above Georgetown, to the North Carolina line, funds for this purpose to be collected by levying a special tax upon the lands lying along the river; 1791, an act to improve the river between points mentioned in 1785 by requiring the male inhabitants of the adjacent counties to work, each, six days in the year at removing obstructions; 1805, an act of this year appropriated \$4,000 for the improvement of the river from Brittons Ferry to the North Carolina line; 1815, an act of this year was passed, which provided for the improvement from the North Carolina line down to Singleton's plantation by the six days' plan. All the above embraces the section of the river now ordered for preliminary examination.

It appears that in the year 1873 the United States Government assumed control of the engineering operations on this river, and it was then examined by Gen. Q. A. Gillmore, Corps of Engineers, United States Army.

Farther on, in 1879, an act of Congress, March 3, provided for a survey of the river below Cheraw. This was executed under the direction of Capt. Charles B. Phillips, Corps of Engineers, United States Army, in October of that year. Upon this survey was based the beginning of the regular project for the improvement of the Great Pedee River from Cheraw to its mouth, at Georgetown, a distance of approximately 172 miles. Captain Phillips recommended that the sum of \$25,520 be expended for this purpose. The survey upon which this estimate was made was very hurried, the water being high, rendering it altogether impossible to furnish an accurate estimate as to cost. Therefore Capt. (now Maj.) William H. Bixby, Corps of Engineers, United States Army, in taking charge of the work, revised the estimate, after having made a more careful examination of the river in 1885, and recommended that the total sum of \$90,000 be expended in clearing the stream of obstructions, it being understood that the section from the Wilmington, Columbia and Augusta Railroad Bridge to Cheraw was to receive its proportionate part of money and work. Captain Phillips's original project of the year 1879-80, and as continued to date, provided for a thorough cleared length of navigation to Smiths Mills, 54 miles

above Georgetown, to 9 feet depth, thence $3\frac{1}{2}$ feet navigation to Cheraw, the head of navigation, at all stages of water. The project contemplated that this depth would probably be acquired by the expenditure of the amount as above mentioned, but as appropriated in small sums, and at intervals of one and two years, it has been barely sufficient to keep the river channel open to navigation, by the removal of logs and fallen timber, from Georgetown 103 miles up to the Wilmington, Columbia and Augusta Railroad Bridge.

No attempt has ever been made to remove any of the shoals by dredging, which will be necessary in order that a navigable channel depth of $3\frac{1}{2}$ feet be secured and maintained, according to the original project.

Below the bridge there are also several shoals, upon which there is said to be less than $3\frac{1}{2}$ feet at dead low water.

COMMERCE AND NAVIGATION—PAST, PRESENT, AND PROSPECTIVE.

The river above the Wilmington, Columbia and Augusta Railroad Bridge seemed to have shoaled in the past few years, or else the water supply is not now what it formerly was, as the steamers apparently are unable to make as frequent trips to Cheraw at present as they did in former years. I am told by Capt. F. B. Cushman, who has commanded and successfully operated steamers on the river for a good many years, that, from his own personal knowledge, the commerce in past years was very much greater than it is now, and the steamers found much less difficulty in running on the river and their trips could be much more surely counted on in getting to Cheraw; but, owing to the probable raising of the shoals and the accumulation of other obstructions, that year by year the boats have been forced to greater irregularity in their trips, until now the commerce is, by comparison, very little or nothing.

It has been stated in a general way, as a matter of interest, in setting forth the value of the Great Pedee River as a highway of commerce, that there has been known to have been shipped many years ago as much as 50,000 bales of cotton from landings between Cheraw and the Wilmington, Columbia and Augusta Railroad Bridge annually.

From the best information attainable there is at this time practically no fixed yearly commerce on the river, except such as is carried on by timber rafts, of which no approximate account could be secured.

The prospective commerce is enough to attract favorable attention toward this stream, as will be seen in the attached statement from the people at Cheraw, Society Hill, and landings along the river, which, being reduced to figures, amounts to, in aggregate, 365,425 tons, valued at \$7,022,500, could the river be navigated continuously at all stages of the water.

The Great Pedee River is known to be one of the most valuable for commerce and trade in the State, and therefore, taking all the foregoing into consideration, is deemed well worthy of continued improvement by the General Government, and it is recommended that a detailed survey of it be made with the view of revising and enlarging the original estimate for its improvement between Cheraw and the Wilmington, Columbia and Augusta Railroad Bridge to $3\frac{1}{2}$ feet depth at dead low water. Such a survey would probably cost \$1,306, including the general map of the river, as well as an extra detailed survey of each shoal, from which to make estimates for dredging, transportation of surveying party, etc.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. J. C. SANFORD,
Corps of Engineers, U. S. A.

COMMERCIAL STATEMENT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

GEORGETOWN, S. C., September 3, 1900.

Statement of prospective commerce from Great Pedee River landings, between Cheraw and Wilmington, Columbia and Augusta Railroad Bridge, excepting from the former place and Society Hill.

Outward freights:

2,200 bales of cotton, at \$40	\$88,000
6,000 sticks of timber, at \$3	18,000
	106,000

Inward freights:	
1,300 tons fertilizers, at \$20.....	\$26, 000
Merchandise.....	70, 000
Total.....	202, 000

REID WHITFORD,
United States Assistant Engineer.

LETTER OF E. T. BARRENTINE, M. D., AND OTHERS.

SOCIETY HILL, S. C., August 29, 1900.

DEAR SIR: Our village is on the Great Pedee River. We have only one railroad by our town, and have to submit to any rate of freight they may charge us. We think if the Pedee was made navigable for steamers the year through, it would be a great advantage to us in securing reasonable freight rates. In answer to your inquiry as to the amount of freights handled at this point, will say:

5,000 bales of cotton.....	\$200, 000
650 carloads brick.....	35, 000
50 carloads timber.....	3, 000
400 carloads wood.....	16, 000
8,000 tons of merchandise, at \$100.....	800, 000

We are glad to know that Congress is about to take some steps toward making our river navigable. We are in the midst of the most fertile part of the State of South Carolina, with fine climate and good water. There are landings above us and below that receive and ship large quantities of freight by steamer when the river is navigable. We are satisfied that a competing carrier would get a good per cent of the above business.

E. T. BARRENTINE, M. D.
Z. W. WINES, P. M.
D. L. WINTERS, J. P.
W. C. COKE & SON.
A. M. SANPAYRAE.
L. E. CARRIGAN.
JNO. E. SUMNER.

MR. REID WHITFORD,
Assistant United States Engineer.

LETTER OF COMMITTEE ON COMMERCE AND NAVIGATION OF THE BUSINESS LEAGUE OF CHERAW, S. C.

CHERAW, S. C., August 28, 1900.

DEAR SIR: In accordance with your request we, the undersigned committee on commerce and navigation, of the business league of the town of Cheraw, hereby submit to you the following report of the probable commerce of the said town of Cheraw, which would result on account of the opening of the Great Pedee River for navigation from the Wilmington, Columbia and Augusta Railroad Bridge across the said river to the town of Cheraw:

75,000 tons fertilizer.....	\$1, 875, 000
Naval stores.....	200, 000
Merchandise.....	1, 000, 000
500,000 sticks of timber.....	1, 444, 000
40,000 bales of cotton.....	1, 800, 000
Probable total.....	6, 319, 000

The town of Cheraw is situated in the northeastern portion of the State of South Carolina, at the head of navigation of the Great Pedee River, and at the intersection of the Seaboard Air Line and the Atlantic Coast Line railroads. It is a progressive town and needs only proper freight rates to make it one of the best commercial and distributing points in the two Carolinas, but on account of the fact that the Great Pedee River is not open to navigation, the town is at the mercy of the two great railroad companies, which now afford the only means by which business with the outside

world can be carried on, and in many instances the high freight rates now in force make it almost impossible to carry on commerce with the outside world to advantage. We not only, under our present condition, can not undersell other points, but in many instances can not even compete with them.

With the rates to which we should be entitled on account of our geographical position, being the only town within 80 miles which could under any circumstances have water navigation, we should have such freight rates that no town could compete with us. Instead of remaining a town of 1,500 inhabitants, and so remaining forever, we should in a very short time, with deep water in the Pedee, become a city of 25,000 inhabitants. Situated in the very heart of the cotton-growing region, with the best class of labor, and with fuel plentiful, with good water and a mild and healthful climate, there is no reason except the high freight rates why Cheraw should not become one of the greatest cotton manufacturing centers in the South. The Seaboard Air Line Railroad has just been completed from Cheraw to Columbia, S. C., and there is now another road under construction from this point to Lancaster, S. C., and these two new roads will no doubt do much toward the development of the town, but that is not all Cheraw needs. The freight rates will not be much, if any, reduced on account of the railroad competition. What we need is water rates to compel all these roads to reduce rates.

As an instance of the high rates now in force, we cite the rates following on cotton:

Freight per hundredweight from Cheraw to New York on cotton.....	\$0. 59
Freight per hundredweight from Cheraw to Liverpool on cotton.....	. 75

From this it will be seen that the rate on cotton from Cheraw, S. C., to Liverpool, England, is only 16 cents per hundredweight higher than it is to the city of New York.

Therefore we, the said committee, hereby respectfully request that a survey of the said section of the Great Pedee River be made as early as possible, and that an estimate be made for the deepening of the channel of the same so as to afford a channel with a draft of at least $3\frac{1}{2}$ feet at any and all times, so that the said report may be submitted at the next session of Congress.

C. A. MALLOY,
T. C. D. MALLOY,
H. W. FINLAYSON,
W. P. POLLOCK,
W. F. STEVENSON,
H. P. DUVAL,

*Committee on Commerce and Navigation of the
Business League of the town of Cheraw, S. C.*

MR. REID WHITFORD,
*United States Assistant Engineer,
Georgetown, S. C.*

SURVEY OF GREAT PEDEE RIVER, SOUTH CAROLINA, BETWEEN CHERAW AND THE WILMINGTON, COLUMBIA AND AUGUSTA RAILROAD BRIDGE.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., November 19, 1900.

GENERAL: I have the honor to submit herewith report, with map,¹ of a survey made by Asst. Engineer Reid Whitford of the Great Pedee River, South Carolina, from Cheraw to the Wilmington, Columbia and Augusta Railroad Bridge, in accordance with the requirements of the emergency river and harbor act of June 6, 1900.

The Great Pedee River has been under improvement by the General Government for about twenty years. The approved project, adopted in 1880 and revised in 1886, provides for a thoroughly cleared 9-foot navigation to Smith Mills, 52 miles above the mouth, and a $3\frac{1}{2}$ -foot navigation to Cheraw, 167 miles above the mouth, at all stages of water, at an estimated cost of \$117,000. The cost of maintenance of the improvement after completion was estimated at \$5,000 annually.

¹ Not printed.

There have thus far been appropriated for this work \$111,500; but owing to the small annual appropriations that have been made the portion of the river above the bridge has not yet been improved, a large sum having been required each year for maintenance, in the way of removing snags and similar obstructions which are constantly forming, of the improved portion, about 103 miles in length, below the bridge.

As shown by the survey, the improvement of a considerable number of shoals will be necessary in order to secure a low-water depth of $3\frac{1}{2}$ feet from the bridge to Cheraw, and the cost of improving them will be much greater than originally estimated, due probably to additional shoaling since the date of that estimate. Mr. Whitford's estimate is, however, in my opinion, too large. It will, I believe, be practicable to maintain a channel by a small amount of occasional dredging, at a much less cost and with greater certainty than by training walls. Bank protection I would also dispense with. With fairly liberal appropriations the cost of removing the snags and logs now in the river can be reduced at least to \$1 each. Making these omissions and change in unit price and retaining the other items of Mr. Whitford's estimate, I should estimate the total cost of improving the river from Cheraw to the bridge to give a $3\frac{1}{2}$ -foot depth at low water at \$118,345.37, and the cost of maintaining the improvement after completion at \$4,000 per year.

The above estimate is based on the assumption that none of the money appropriated for the work has to be spent in maintenance. While the improvement is in progress it will be necessary each year to remove the snags, logs, etc., that may get into the channel, and for this purpose \$2,000 per year will be required in addition to the improvement appropriations.

The improvement of the Great Pedee River to Cheraw to the extent contemplated will benefit a large section of productive country by greatly reducing freight rates. This whole section, of which Cheraw is the center, is now remote from water transportation and the railroad rates are correspondingly high. The section in question is rich in cotton, naval stores, and timber, and imports large quantities of fertilizer; and it is my opinion that its development will be assisted to such an extent by the improvement of the river as to fully justify the cost of the improvement.

Very respectfully, your obedient servant,

J. C. SANFORD,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 28, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

The prospective commerce of this river is an uncertain and indefinite quantity. In the report on the preliminary examination the district engineer stated that it was represented by interested parties as amounting to over \$7,000,000 in value. In my indorsement on the report I

stated that I doubted that large estimate, and there is nothing in this report on the survey to change my views in that respect.

To my mind neither the present nor prospective demands of the commerce of the portion of the stream treated in this report will justify its improvement at this time by the United States at the estimate of the assistant engineer, which is \$241,650.97. I concur, however, in the opinion of the district engineer that it is worthy of improvement by the General Government to the extent of about \$119,000 with \$4,000 annually for maintenance, provided sufficient funds be furnished to carry on the operations uninterruptedly and without recourse to maintenance until a 3½-foot navigation is completed throughout the 64 miles of this portion of the river.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

REPORT OF MR. REID WHITFORD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Georgetown, S. C., November 12, 1900.

CAPTAIN: I have the honor to report as follows on the survey of the Great Pedee River, South Carolina, from Cheraw to the Wilmington, Columbia and Augusta Railroad Bridge, in accordance with the emergency river and harbor act of June 6, 1900, and in compliance with instructions contained in your letter of September 29, 1900:

The method of survey consisted in zigzag stadia measurements and compass bearings from shore to shore, beginning under the county bridge at Cheraw and extending down to the Wilmington, Columbia and Augusta Railroad Bridge, a distance of about 64.1 miles. Soundings at sufficiently close intervals were taken on these lines to determine the depth of the river from bank to bank. In addition, where a channel depth of less than 3½ feet at dead low water was found to exist, these shoals were more thoroughly sounded and plotted on a scale of 1 inch to 100 feet, from which the following estimate is made. The river being most of the time during the progress of the survey at its dead low stage afforded a most favorable opportunity for securing correct soundings.

Only the characteristic depths could be shown on the accompanying tracing, owing to its small scale. Generally, however, it gives a correct idea of the appearance of the stream and designates all the shoal places where dredging may be necessary. The river has plenty of width, ranging from about 245 to 400 feet, even at its dead low stage, and carries a very good supply of water indeed.

The survey developed the fact that between its initial and terminal points there are 16 shoal places with less than 3½ feet on them at dead low water, as follows: (1) Lower Pocket Shoal, (2) Kings Pocket Shoal, (3) Cashway Cut Shoal, (4) Sugar Loaf Shoal, (5) Askew Falls Shoal, (6) Famine Falls Shoal, (7) Buzzard Bar Shoal, (8) Snowdens Shoal, (9) Whirligig Shoal, (10) Rogers Shoal, (11) Cheraw Bay Shoal, (12) Indian Hill Shoal, (13) Fish Tail Shoal, (14) Terrels Shoal, (15) Mother Griffin Shoal, (16) Thompson Creek Shoal.

Of these, by far the most formidable, and those which seem to present more difficulties against their removal, are Cashway Cut and Mother Griffin, because they are composed of hardpan bottom and are very shallow, having unusually swift currents, being cut-offs or break-throughs from one point on the river to another, the old course around gradually filling up and becoming unfit for navigation.

Most of the shoals consist of sand and pebbles, which may be disposed of by centrifugal pump dredging. Others of them are hardpan, which may require blasting and dredging with a scoop arrangement.

A great deal of the river banks is eroding under the action of freshets. Much of this will require protection to add to the permanency of an improved channel, and this may be done by driving piles and filling in behind with logs and brush. Much of this filling can probably be supplied by snags and logs taken from the river bed.

For the most part the river is obstructed at present by logs, snags, and fallen timber. Possibly when these are removed some of the shoals may wash out and disappear, as they may be held in place now by accumulation of sand and silt about sunken logs, etc.

There are at Cashway Cut and Mother Griffin break-throughs or cut-offs where it might be advisable to dam the old river with piles and log filling to force the current more entirely through the cut-offs or new channels which are now used by steamers. The depths both above and below the shoals are by comparison considerable, so that the supply of water would be constant, though the top of the shoals be lowered in improving the river to 3½ feet at dead low water.

After once removing the shoals by dredging, in order to maintain the depth thus gained it would probably be necessary to direct the main flow of the current through this channel by the use of training walls, built with their crest about 3 feet above the dead low-water plane. It is believed that such structures should be built of riprap stone, which may possibly be found in sufficient quantities in the vicinity. Anything of this kind built of timber would in time decay and of itself form an obstruction to navigation. Therefore the following estimate of the probable cost of improving the 64.1 miles of river is respectfully submitted:

ESTIMATE.

155,289 cubic yards pebbles, at 30 cents per cubic yard	\$46,586.70
8,960 cubic yards hardpan or soft sandstone, at 40 cents	3,584.00
89,100 cubic yards sand, at 20 cents	17,820.00
3,820 linear feet riprap stone training walls, at \$6	22,920.00
32,700 linear feet bank protection, at \$2	65,400.00
23,776 snags and logs, at \$2	47,552.00
7,230 overhanging trees, at \$1	7,230.00
1,580 cords of brush, at 50 cents	790.00
520 linear feet timber and pile dam, at \$15	7,800.00
	219,682.70
Add 10 per cent for superintendence and contingencies	21,968.27
Total	241,650.97

or about \$3,770 per mile of river.

After the improvement is finally completed there will probably be required at least about \$6,400 annually to maintain it, or about \$100 per mile per year.

COMMERCE.

From this point of view the whole length of the stream seems to be of unusual importance. It flows through an exceedingly fertile section of the State, where large quantities of cotton and other farm products are annually marketed. The lack of facilities for transportation at low water over the Great Peedee River necessitates hauling by wagons, in many instances, long distances to markets or to railroad stations.

Cheraw is of such commercial magnitude as described in the accompanying report from a committee of citizens of that place. Doubtless the navigation of the river at all stages of the water would prove of vast benefit, not only to Cheraw, but also to Society Hill, a town 17 miles farther down, as well as all intermediate landings, as they are now forced to ship by rail at arbitrary rates.

At present there is very little, if any, steamboat traffic on the river above the Wilmington, Columbia and Augusta Railroad Bridge. In former years the commerce over that part of the river alone was said to have been worth several hundred thousand dollars annually. But the running of the steamers became irregular in their trips, and in consequence the commerce naturally drifted away from the river and sought an outlet to and from market by other means. In old times the regular running of the boats possibly had a tendency to keep the shoals deepened by the action of their paddle wheels stirring up and sweeping off the sand and pebbles. It is said that since this regular steamboat traffic ceased the depth on the shoals has become less, and now it is impossible to navigate the river at all except at its flush-water periods.

The prospective commerce appears to be very large, should the river be open for navigation every day in the year, and from the best information attainable it would be approximately as follows:

CHERAW.

As per attached report of committee on commerce and navigation:

STATE OF SOUTH CAROLINA,

County of Chesterfield, Town of Cheraw.

The undersigned, committee on commerce and navigation of the business league of the town of Cheraw, beg leave to submit the following report:

The town of Cheraw is situated in the northeastern part of the State of South Carolina, at the head of navigation of the Great Peedee River and at the intersection

of the Seaboard Air Line Railroad, the Atlantic Coast Line Railroad, and the Chesterfield and Lancaster Railroad, which is now under construction, and another road which is projected and is partly built from a point on the Atlantic coast and running by the towns of Conway, Marion, and Bennettsville, S. C., to Cheraw. It is also the central market point for five counties, two in North Carolina and three in South Carolina, and is the only point within one hundred miles which can have the advantage of water navigation and the consequent reduction in freight rates. It should therefore become, with water transportation, the distributing point for a very large territory, as it was before the age of railroads, when water transportation was the only means of carrying freight.

The town now has about twenty-five mercantile establishments, which annually import at least \$500,000 of goods, four of such establishments doing annually from \$250,000 to \$300,000 of business. This amount would be readily doubled and would reach \$1,000,000 per annum.

The fertilizers annually amount to 5,000 tons, worth \$100,000, and as the freight charges are a very material item in the cost of fertilizers, with the reduction in cost of freight the price at which they could be sold in Cheraw would be far less than at other competing points and the business would probably be increased several hundred per cent. It is estimated that not less than 15,000 tons of fertilizers would be sold at this point.

Another article in which the freight makes a great difference in price and which would be sold from Cheraw at a much lower rate, and which would result in great increase in the trade, would be salt.

Before the time of railroads Cheraw annually shipped about 40,000 bales of cotton, averaging 500 pounds weight. On account of the fact that we now have no advantage over other local markets in the matter of freight, Cheraw now handles only about 12,000 or 15,000 bales annually. With water navigation this should be easily increased to 35,000 or 40,000 bales annually.

The timber resources of this section are almost limitless. The distance from Cheraw to Society Hill, S. C., by river, is about 20 miles, and for one mile on each side of the river there is a magnificent forest of hard woods and pine. This territory would cut at least 250,000,000 feet of lumber (25,000 acres). There are now twenty mills in this vicinity, cutting annually 30,000,000 feet of pine lumber, all of which is being shipped from or through Cheraw, and there is a vast extent of timber lands which now can not be developed on account of the fact that suitable rates can not be had. The South Carolina exhibit of woods at the Atlanta Exposition was the best there, and all this was gotten out in the vicinity of Cheraw.

Being in the midst of the vast pine forests, the amount of naval stores which would be produced and shipped can not be estimated. This business is now great, but the increase would be immense. Thousands of barrels of rosin and turpentine are now annually shipped from this point.

There are vast deposits of kaolin in the vicinity of Cheraw, but on account of the high rates for shipment this can not now be profitably mined. Perhaps the greatest kaolin beds in the United States are to be found in Chesterfield County, and with low rates of freight the amount which would be shipped would be immense.

There is a magnificent water power on the Great Pedee River only a short distance from the town of Cheraw which should be developed and used for manufacturing purposes, and with water transportation the chances are much greater for its development than at present. The report¹ of the engineer who recently made a survey of this is attached hereto, and made a part of this report.

All of which is respectfully submitted.

C. A. MALLOY, *Chairman.*

A. L. EVANS,
H. D. MALLOY,
W. F. STEVENSON,
H. P. DUVAL,
H. W. HARRALL,
H. W. FINLAYSON,

Committee.

W. P. POLLOCK,

Secretary Business League, Society Hill, S. C.

SOCIETY HILL, S. C., August 29, 1900.

DEAR SIR: Our village is on the Great Pedee River. We have only one railroad by our town and have to submit to any rate of freight they may charge us. We think if the Pedee was made navigable for steamers the year through it would be a great advantage to us in securing reasonable freight rates.

¹ Not received.

In answer to your inquiry as to the amount of freights handled at this point will say:

4,000 bales of cotton	\$200, 000
650 carloads brick	35, 000
50 carloads timber	3, 000
400 carloads wood, at \$40	16, 000
8,000 tons of merchandise.....	800, 000

We are glad to know that Congress is about to take some steps toward making our rivers navigable. We are in the midst of the most fertile part of the State of South Carolina, with fine climate and good water. There are landings above and below us that receive and ship large quantities of freight by steamer when the river is navigable.

We are satisfied that a competing carrier would get a good per cent of the above business.

W. C. COKER & SON.
E. T. BARENTINE, M. D.
Z. W. WINES, P. M.
D. L. WINTERS.
A. M. SOMPAYRAC.
L. E. CARRIGAN.
JNO. E. SUMNER.

MR. REID WHITFORD,
Assistant United States Engineer, Georgetown, S. C.

Other landings on the river (collected by Mr. William H. Johnstone during the survey):

Outward freights:

20,000 bales of cotton, 5,000 tons, valued at.....	\$1, 000, 000
10,000 tons cotton seed, at \$15, valued at.....	150, 000

1, 150, 000

Inward freights:

10,000 tons fertilizers, at \$18.....	180, 000
12,000 tons general merchandise, at \$60	720, 000

Total 2, 050, 000

No estimate could be formed of the amount of naval stores, timber, shingles, cross-ties, corn, and other products which would probably pass over the river from these intermediate landings. They would evidently amount to no little each year.

For full history of the efforts in the past, made to improve the Great Pedee River, see report on examination of this stream September 8, 1900.

Mr. William H. Johnstone, surveyor, rendered valuable service in completing the survey thoroughly, and in a most satisfactory manner, in a short time.

Very respectfully, your obedient servant,

REID WHITFORD,
Assistant Engineer.

Capt. J. C. SANFORD,
Corps of Engineers, U. S. A.

M 15.

EXAMINATION AND SURVEY OF ASHLEY RIVER, SOUTH CAROLINA.

[Printed in House Doc. No. 115, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 4, 1900.

SIR: I have the honor to submit herewith copies of reports, dated September 10, 1900, and November 20, 1900, by Capt. J. C. Sanford,

Corps of Engineers, upon preliminary examination and survey, respectively, of Ashley River, South Carolina, from the city of Charleston to the head of navigation, authorized by the emergency river and harbor act approved June 6, 1900.

The plan of improvement presented provides for increasing the navigable depth of certain reaches on the river to 13 and 20 feet at mean low water, and the removal of snags and other obstructions in the extreme upper portion. The cost of the proposed work is estimated at \$264,396.29. Captain Sanford states that in his opinion this improvement is justified by the amount and character of the commerce involved, and his views are concurred in by the division engineer, Col. Peter C. Hains, Corps of Engineers.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF ASHLEY RIVER, SOUTH CAROLINA, FROM
CHARLESTON TO THE HEAD OF NAVIGATION.

PALMYRA, N. Y., *September 10, 1900.*

GENERAL: I have the honor to submit the following report of an examination of Ashley River, South Carolina, from the city of Charleston to the head of navigation, made August 30, 1900, in accordance with the terms of the emergency river and harbor act of June 6, 1900.

This river was originally examined and partially surveyed under Gen. Q. A. Gillmore, Corps of Engineers, under the act of March 3, 1872. His report and project of improvement are printed as Appendix S 8 of the Annual Report of the Chief of Engineers for 1873, page 756.

Appropriations were made from time to time, aggregating \$5,500, which sum was spent mainly in dredging through two shoals in the lower part of the river, known as Cowhead and Stono shoals. The first was dredged to 11 feet, and the second to 12 feet at mean low water. This work was done from 1882 to 1892.

The present examination extended from Bacon's Bridge, which is usually considered the head of navigation, to the city of Charleston.

At Bacon's Bridge the river is about 90 feet wide. The bridge has no draw, but there is a central span of about 30 feet, which is wide enough to allow rafts and flatboats of moderate size to pass through under the bridge. Just below the bridge the river is from 100 to 150 feet wide and the banks are lined with trees. Some of them are large and their limbs extend over half of the width of the river, consequently there are many snags and the navigation of this portion of the river is dangerous. The river gradually widens, and, after the entrance of Eagle Creek on the east bank, about $1\frac{1}{2}$ miles from the bridge, it is estimated to be about 250 feet wide. The Gregg mines are about $6\frac{1}{2}$ miles from the bridge and probably about 23 miles from Charleston. Below this point the character of the river changes, and it runs between marshes touching the high ground here and there, generally in bends.

Some of the high banks are of marl formation, worn smooth by the current, but very tenacious.

From the Gregg mines on the west bank to Lamb's on the east bank, a distance of 8 or 9 miles, the river is from 300 to 500 feet wide. At Lamb's it begins to widen and becomes gradually wider until it enters Charleston Harbor with a width at its mouth of about 1 mile.

The total length from Bacon's Bridge to the mouth is about 30 miles, which figure is only an approximation, for some of the available maps are inexact.

From Lambs to Charleston, a distance of about 15 miles, the river has been surveyed at a comparatively recent date by the United States Coast and Geodetic Survey.

There is one railroad bridge crossing the river at Bees Ferry, about 12 miles from Charleston, which is provided with a good draw having two openings. The river is also crossed at the upper end of the city of Charleston by a highway bridge with a draw having two openings. This draw is at present in a wrecked condition, having been run into by a steamer, but navigation is not interfered with. The river is navigable at high water for sea-going vessels drawing about 15 feet as far as Fetteressa, 12 miles from Charleston, and for 12-foot draft to Lambs, 15 miles. Schooners also go up to the Ashley Phosphate Works, about 20 miles, and probably have gone up occasionally to the Gregg mines. Several shoal places are shown on the Coast and Geodetic Survey chart, and there are doubtless others above as far as Gregg's mines. Above this point the river is quite shallow. There is a rise of tide of between 5 and 6 feet as far up as the Gregg mines. At Bacon's Bridge it is probably less. The main business on the upper portion of the river from Fetteressa to the Gregg mines is the mining and washing of phosphate rock.

The refuse from the washings formerly went into the river, but most of the companies have now arranged to deposit their refuse upon the land. Their arrangements are not perfect in all cases, as was observed during the course of examination. While the refuse is dumped upon the land, the water bearing the material from the washers is not entirely cleared of the refuse when it reaches the river. The large areas of marsh lands in this section give ample room for this refuse, but at least in some instances dikes should be built in order to form settling basins, and these should be constantly maintained at the expense of the companies owning them. One concern still dumps into the river, but they are now making arrangements to move their washer to another point and will then discharge their refuse upon land. This change will be made by October 15 next. Maps on file in my office show that serious shoaling has occurred in at least one portion of the river, which is directly traceable to this practice.

The river is an important feeder to the commerce of Charleston. The volume of business is very much greater in the lower part than in the upper, due to the fact that most of the manufactories, or fertilizer works, are not far above the city. As these use phosphate rock from the upper portions, the business is linked together into a uniform whole and all are interested in the improvement of the river. The obstructions to navigation are the shoals already alluded to, and, in the extreme upper portion, snags and overhanging trees.

The following commercial statistics have been compiled from various sources, and are believed to represent fairly the business using as a transportation route that portion of the river which has been examined:

Annual commercial statistics for Ashley River, as shown in 1900.

	Tons.	Value.
Pyrites.....	67,000	\$497,000
Coal.....	42,500	158,000
Acid fish.....	6,200	80,000
Tankage.....	5,000	35,000
Manure salt.....	12,050	301,000
Kainit.....	17,500	172,000
Muriate.....	2,200	107,500
Nitrate.....	4,000	180,000
Sylvinit.....	1,000	13,000
Calcined marl.....	2,000	7,000
Phosphate rock.....	223,173	830,000
Manufactured fertilizers.....	21,000	234,000
Lumber.....	16,000	92,100
Logs.....	6,000	18,000
Cord wood, blocks, laths, and shingles.....	900	4,900
Vegetables.....	1,300	40,000
Merchandise, machinery, supplies, etc.....	1,000	165,000
Total.....	428,823	2,934,500

For reasons shown in the foregoing report, I regard this river as worthy of improvement. In order to prepare plans and estimates a survey will be required. That portion of the river from Bacons Bridge to the Gregg mines needs only a careful examination for snags and similar obstructions. The recent surveys of the United States Coast and Geodetic Survey will render unnecessary a resurvey of all of the lower portion. The necessary surveying and mapping will cost \$1,400.

Very respectfully, your obedient servant,

J. C. SANFORD,
Captain of Engineers.

Brig Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., September 14, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

From an examination of the commercial statistics for the Ashley River, as shown in the report herewith of the district engineer, it is believed that this river is worthy of improvement, but to what extent it is difficult to say until a careful survey and an estimate of the cost have been made.

It is noticed that the main business on the upper portion of the river is the mining and washing of phosphate rock, and that some of the companies engaged in this work allow the refuse from the washing to go back into the river. Captain Sanford states that serious shoaling has occurred in at least one portion of the river, which is directly traceable to this practice. If this dumping of refuse matter into the river is sufficient to become injurious to navigation, it is doubtful

whether or not the Government should undertake the work. As the practice is in direct violation of section 13, river and harbor act of March 3, 1899, it should be stopped.

The volume and diversity of the business on this river are such as to justify the survey, and it is accordingly recommended.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 18, 1900.

Respectfully submitted to the Secretary of War.

This report relates to a preliminary examination of Ashley River, South Carolina, from the city of Charleston to the head of navigation, made to comply with the requirements of the emergency river and harbor act of June 6, 1900.

The river is reported to be worthy of improvement by the General Government, and I recommend that a survey be made and the cost of improvement be estimated.

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

[Third indorsement.]

WAR DEPARTMENT,
September 19, 1900.

Approved as recommended by the Chief of Engineers.

G. D. MEIKLEJOHN,
Acting Secretary of War.

SURVEY OF ASHLEY RIVER, SOUTH CAROLINA, FROM CHARLESTON TO
THE HEAD OF NAVIGATION.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., November 20, 1900.

GENERAL: I have the honor to submit herewith a report, with map¹ (6 sheets), of a survey made under direction of Asst. Engineer James P. Allen, of the Ashley River, South Carolina, from the city of Charleston to the head of navigation, in accordance with the requirements of the emergency river and harbor act of June 6, 1900. The portion of the river covered by the map extends from the Gregg mine wharf to the mouth of Old Town Creek, a distance of 19½ miles. Below Old Town Creek there is a good 20-foot channel to the mouth of the Ashley, 6½ miles. An examination of the river above, from the Gregg wharf to Bacons Bridge, was also made to determine cost of removing snags and similar obstructions.

The results of the survey show that by the removal of about 300,000 cubic yards of sand and mud, a channel of 240 feet average width and 20 feet depth at mean low water can be secured from the mouth to the Standard wharf. This will enable large ocean steamers to reach the

¹ Not printed.

wharves of the principal fertilizer factories on the river. From the Standard wharf to the Ashley phosphate wharf a greater depth than 13 feet at mean low water could not be secured except at great cost, due to the large amount of dredging that would be required and the fact that much of the dredging would be in marl and phosphate rock; moreover, a depth of 13 feet will, it is thought, sufficiently accommodate the business of the phosphate washers and fertilizer factory on this reach. For this portion, dredging a channel 13 feet deep at mean low water, of an average width of 220 feet, from the Standard wharf to the head of the shoal next above Lambs, thence of an average width of 150 feet to the Ashley phosphate wharf, is recommended.

From the Ashley phosphate wharf to the Gregg mine wharf increased depth would be very costly, the river bottom being largely marl, and the commerce interested is comparatively small. No improvement of this reach is recommended. From the Gregg mine wharf to Bacons Bridge, which is generally considered the head of navigation, the removal of the snags, etc., now obstructing the channel, which is estimated to cost \$1,000, would in my opinion be justified, as this portion of the river is considerably used by rafts, lighters, etc. The total estimated cost of the improvement as above described, including the removal of snags, etc., from the upper section, is \$264,396.29.

The imports and exports by water of the fertilizer works on the Ashley River form a considerable part of the total commerce using the Charleston Harbor entrance. As the depth over the bar has been much increased within the past few years, being now about 23 feet at mean low water, larger vessels have been enabled to reach the mouth of the Ashley. As most of the imports and exports of the fertilizer factories is carried in ocean steamers, it is important, in the interest of low freight cost, that the channel depth in the Ashley should be increased so far as practicable within a reasonable limit of cost. In my opinion the improvement proposed in this report is justified by the amount and character of the commerce interested.

The dumping of refuse from the phosphate washers into the river, and the depositing of refuse on the marshes in such a way that a portion of it is carried into the river, referred to in my report on preliminary examination of this river, has been stopped, and further injury to the channel from this cause is not apprehended.

Very respectfully, your obedient servant,

J. C. SANFORD,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., November 28, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

The value of the annual commerce of this river is large, and the character of it justifies the Government in improving the navigation.

The business of mining and washing of phosphate rock carried on in the upper reaches of the river at one time caused an obstruction to

navigation, as the refuse was permitted to run into the river, where it formed shoals. That practice was in violation of section 13 of the river and harbor law approved March 3, 1899, and the district engineer reports that it has now been stopped.

The marl and phosphate rock to be dredged in that portion of the river extending from the Standard wharf to the Ashley Phosphate wharf is of value, and it is possible that if the specifications for dredging permitted the contractor to dispose of it for his own profit a greater depth than 13 feet might be secured, if it were desirable. However, the district engineer reports that 13 feet depth is sufficient to accommodate the commerce of that portion of the river. The statement of the assistant engineer, "that the marl and phosphate rock can be dredged only with a powerful dipper or grapple machine," is scarcely warranted by the facts. The endless-bucket type of dredge, such as is used very successfully in Baltimore Harbor, is much better for removing this character of material than either of the models he mentions.

I concur in the opinion of the district engineer that the river is worthy of improvement by the United States to the extent indicated in his report.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

REPORT OF MR. JAMES P. ALLEN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., November 17, 1900.

CAPTAIN: I have the honor to submit the following report relating to the survey of the Ashley River:

The field work was in charge of Mr. R. T. Crawford and was done between the dates October 11 and November 8, 1900.

The actual survey began at Greggs and extended to the end of the Cowhead Reach. Below this the channel only was sounded, and the shores and low-water lines were obtained from the charts of the United States Coast and Geodetic Survey. An examination was also made at a low stage of the tide of the upper portion, from Greggs to Bacons Bridge, by two of the field party, to ascertain the number of snags and the rock which would have to be moved to improve the navigation of this stretch for rafts and small tugs towing lighters. The map of the survey was begun as soon as notes could be obtained. It has been platted to a scale of 1 inch to 200 feet from the upper end to the Accabee Reach, and tracings of this are submitted in five sheets. Below this and including most of the Accabee Reach, the soundings were platted to a scale of 1 inch to 500 feet, the shores and some soundings being supplied from the Coast and Geodetic Survey detail sheet made in 1894-95. This is called sheet No. 6.

The only improvement of the river which is practicable must be secured by dredging, and this work is seriously complicated by the absence of suitable dumping grounds and by the character of the bottom in some portions of the river, which is marl and phosphate rock. If the bottom were of sand and mud exclusively the dredgings might be pumped ashore upon the wide expanse of marsh land lining the river on both sides for the greater portion of its length. The marl and phosphate rock can be dredged only with a powerful dipper or grapple machine. Most of the dredged material would have to be towed entirely through to Charleston Harbor for dumping; otherwise it will be liable to re-form in shoals below the holes where it might be dumped. Some of the rock and marl could be dumped in these deep holes without danger of giving further trouble.

The actual cost of dredging marl, as well as the relative proportions of the marl to other materials, can only be determined by actual experiments in dredging. Lacking the information which such an experiment would give, an accurate preliminary estimate can hardly be made. No precedent for work of this character is known. The

marl will probably be more easily dredged than phosphate rock, or other rock in place found in this region, such as that near Port Royal. Prices for dredging this last have been in the neighborhood of \$1 a yard. Inasmuch as the marl and phosphate rock are combined with other material, the prices given are probably sufficient, if the main work be done under a single contract.

An increasing price has been used from the lower portion upward because of the longer tow for the upper part, and also because it is in this part that most of the marl occurs. The Government did some dredging at Cowhead shoal and near the Stono works some years ago, and no serious obstacle in the way of marl or rock was encountered at these places.

The following prices have been consequently adopted:

	Per cubic yard.
From the lower end to the Standard wharf, which is to be dug to 20 feet depth.	\$0. 18
From the Standard wharf to the foot of the Cowhead reach	. 15
For Cowhead shoal	. 20
For that portion above the railroad bridge of the Charleston and Savannah Railroad and opposite the wharf of the Charleston Mining and Manufacturing Company	. 25
For the White House crossing and the reach above, because of marl at White House crossing	. 30
For the portion above Magnolia Garden and as far as Millbrook, there being a great deal of marl in this portion	. 35
For that between Millbrook and the Ashley Phosphate wharf, there being a great deal of marl in this portion	. 40

From the last-mentioned point to Greggs the river is not worthy of improvement. The cost would be excessive to secure even a 9-foot channel on account of the marl bottom. The estimate is made for a channel of 240 feet average width and 20 feet depth from the mouth of Old Town Creek to the upper wharf of the Virginia-Carolina Chemical Company; thence for 220 feet wide and 13 feet deep to include the shoal above Lambs, and thence for 150 feet wide and 13 feet deep to the Ashley Phosphate Company.

In the upper stretch the same marl formation occurs, and it is stated that there are several ledges of this material which cross the river and leave but a very small and shallow channel at low water. I do not think that the present interests of navigation warrant the removal of this marl. This portion of the river contains at present many snags and overhanging trees, the removal of which would facilitate the navigation of this stretch. About 175 such obstructions were counted, and there are probably others which could not be seen. It is estimated that the amount of \$1,000 is sufficient to clear of obstructions this 6 or 7 miles of the river, and its improvement to this extent by the Government seems to be warranted.

Estimate for dredging (scow measurements).

Old Town Creek to head of Standard wharf, 240 feet average width, 20 feet depth, 304,554 cubic yards, at 18 cents	\$54, 819. 72
Standard wharf to foot of Cowhead reach, 111,581 cubic yards, at 15 cents	16, 737. 15
In Cowhead reach, 196,494 cubic yards, at 20 cents	39, 298. 80
Opposite wharf of Charleston Mining Company, 28,761 cubic yards, at 25 cents	7, 190. 25
White House reach and above to Draytons, 193,807 cubic yards, at 30 cents	58, 142. 10
Shoal above Lambs, 91,467 cubic yards, at 35 cents	32, 013. 45
Near Runnimeade, 34,547 cubic yards, at 35 cents	12, 091. 45
One-half mile below Millbrook, 17,875 cubic yards, at 35 cents	6, 256. 25
Between Millbrook and Ashley wharf, 32,255 cubic yards, at 40 cents	12, 902. 00
	239, 451. 17
Add 10 per cent for superintendence	23, 945. 12
Total	263, 396. 29

Commercial statistics for this river were submitted with the report of the examination made in August, 1900.

Very respectfully, your obedient servant,

JAMES P. ALLEN,
Assistant Engineer.

Capt. J. C. SANFORD,
Corps of Engineers, U. S. A.

APPENDIX N.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA; OF INSIDE WATER ROUTE BETWEEN SAVANNAH, GEORGIA, AND FERNANDINA, FLORIDA, AND OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

REPORT OF CAPT. CASSIUS E. GILLETTE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Savannah Harbor, Georgia. | 9. Brunswick Harbor, Georgia. |
| 2. Savannah River, Georgia. | 10. Inside water route between Savannah, Georgia, and Fernandina, Florida. |
| 3. Savannah River above Augusta, Georgia. | 11. Cumberland Sound, Georgia and Florida. |
| 4. Doboy bar, Georgia. | 12. Removing sunken vessels or craft obstructing or endangering navigation. |
| 5. Darien Harbor, Georgia. | |
| 6. Altamaha River, Georgia. | |
| 7. Oconee River, Georgia. | |
| 8. Ocmulgee River, Georgia. | |

SPECIAL REPORTS.

13. Engineering methods.

EXAMINATION AND SURVEY.

- | | |
|------------------------------------|---------------------------------|
| 14. Brunswick, Georgia, Outer Bar. | 16. Skiddaway Narrows, Georgia. |
| 15. Savannah Harbor, Georgia. | |

HARBOR LINES.

17. Savannah River at Savannah, Georgia.
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UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 11, 1901.

GENERAL: I have the honor to transmit herewith my annual report for the fiscal year ending June 30, 1901, upon the works of the river and harbor improvements in my charge.

CASSIUS E. GILLETTE,
Captain of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

N 1.

IMPROVEMENT OF SAVANNAH HARBOR, GEORGIA.

Savannah Harbor proper is formed by the navigable part of the tidal portion of Savannah River lying within and below the limits of the city of Savannah—that is, Front River and North channel from the old waterworks down to the sea. In a wider sense of the word the term Savannah Harbor comprises both branches of the river—that is, Front River, North channel, and Back River, South channel, from Cross Tides down to the sea.

PRESENT PROJECT OF IMPROVEMENT.

On July 22, 1890, a project was adopted providing for a mean high-water depth of 26 feet from the city to the sea. This project is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890. It provides for a depth of 26 feet at mean high water, with channel widths of 300 and 400 feet between the old waterworks and the ocean. The channel depth contemplated by it, between the Central Railroad wharves and the ocean, was reported complete at the end of the fiscal year 1896. The widths, however, were only from 210 to 250 feet through the shoals.

There was submitted on December 7, 1894, a modified plan of improvement, providing for a detached extension of the Oyster Bed training wall for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee knoll against the destructive action of heavy storms.

The report of July 1, 1895 (being the local officer's annual report for that year), recommended extensive dredging for maintenance and suggested extensive dredging for further improvement. The opening of an inside route between Savannah, Ga., and Beaufort, S. C., was provided for in a report dated January 22, 1895, and found printed on pages 1521 to 1525, Annual Report of the Chief of Engineers for 1895.

These projects were combined in one and authorized by law of June 3, 1896, as an extension and modification of the existing project of 1890, adopted by law in 1892.

A history of the work to June 30, 1900, will be found on page 1913, Annual Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Dredging under contract dated January 16, 1900, by George T. Warner, for opening the inside route to Beaufort, S. C., was continued until July 20, 1900, when the contract was completed. The total amount dredged was 675,046.4 cubic yards, at 9 cents per yard.

A contract for dredging in the upper part of the harbor, between the Central Railroad wharves and the old waterworks, was made October 6, 1900, with George T. Warner, at 12.4 cents per cubic yard. Dredging was begun December 3, 1900, and the work was completed on June 29, 1901. There were removed 219,933 cubic yards of material, besides 106 logs encountered in dredging.

Dredging under oral agreement, at 13 cents per cubic yard, was

begun by Rittenhouse R. Moore on October 22, 1900, and completed May 31, 1901. There were removed 57,000 cubic yards from the lower flats and 99,813.4 cubic yards from the new cut through Mud River.

The survey of the harbor begun in March, 1900, was completed.

CONDITION OF WORK JUNE 30, 1901.

At the close of the present fiscal year the following depths and widths of channel at mean low water exist:

From the old waterworks to the upper end of the Central Railroad wharves the channel is from 100 to 300 feet wide and from 19 to 22 feet deep; along the city front, 200 feet wide and 20 feet deep; at "the wrecks," from 100 to 200 feet wide and 20 to 20.5 feet deep; at "obstructions," from 100 to 200 feet wide and 20.5 to 21 feet deep; at upper flats, 200 feet wide and 19.5 feet deep; at lower flats, 200 feet deep and 20 feet deep; at Long Island crossing, 150 to 200 feet wide and 17.1 to 19 feet deep; at Oyster Bed shoal, 200 feet wide and 20 feet deep; at Tybee knoll, 100 to 200 feet wide and 18.3 to 20.5 feet deep. On the bar the channel is 300 feet wide and 20 feet deep.

From this it will be seen that the controlling depth is 17.1 feet at Long Island crossing. The channel is therefore somewhat shoaler and very much narrower than the channel provided for in the project of 1890, adopted by Congress in 1892, which provided for a channel 26 feet deep at mean high water, and from 300 to 400 feet in width.

COMMERCE AND NAVIGATION.

Full discussions of the commerce of Savannah were given in the reports of the Chief of Engineers for 1890, pages 1252 and 1253, and for 1897, page 1497.

The regular lines of steamships established between this port and New York, Baltimore, and Philadelphia comprise a total of 16 steamers, of which 6 run to the first-named port and 10 to the last-named two. During the calendar year 1900 they made 381 round trips and carried 660,458 tons of freight.

On the inland waters there are a number of small steamers plying between Savannah and adjacent ports, besides numerous schooners and small sailboats. It is estimated that for the year 1900 this portion of the commerce amounted to 225,000 tons of freight, valued at about \$2,300,000.

The chief articles of export are cotton, lumber, and naval stores, of which the shipments for the year 1900 were as follows: Of cotton, 1,101,110 bales; of lumber, 178,466,256 feet; and of naval stores, 333,944 barrels of turpentine and 1,126,622 barrels of rosin.

There were also received at Savannah, for local consumption, by raft and on lighters, about 2,500,000 feet B. M. of lumber and timber, valued at about \$22,600.

The total tonnage of the port, inward and outward bound, coastwise and local, during 1900, was 2,804,061 tons, valued at \$57,428,217.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1900, \$69,453.90. The nearest lighthouses are those upon Savannah River, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

The act of Congress approved June 6, 1900, provided for a preliminary examination and survey, with a view to providing a 28-foot channel from Savannah to the ocean. The report on the preliminary examination was submitted under date of September 27, 1900, and is printed as House Ex. Doc. No. 123, Fifty-sixth Congress, second session. This report was referred to a Board of Engineer officers, which considered a complete survey of the of the harbor previously made, and submitted its report under date of November 21, 1900, which is also printed as House Ex. Doc. No. 123, Fifty-sixth Congress, second session.

The total expenditures under the present project up to June 30, 1901, amounted to \$660,077.53.

The full amount of the expenditure authorized by act of Congress approved June 3, 1896, viz, \$1,005,000, for the completion of the present project, has now been appropriated. The balance available is \$425,408.20. Two boards of Engineer officers have reported that further work on the breakwater part of the project is inadvisable. The Board that reported under date of November 21, 1900, recommended the adoption of a new project providing for a depth of 28 feet at mean high water, at an estimated cost of \$1,039,135, in addition to the amount of funds then on hand. Should an appropriation for this be made no funds will be required for the maintenance of the channel to June 30, 1903. Should this not be done and the present project adhered to there will be required for the completion of the extensions of the Oyster Bed training wall, estimating rock at the prices of the present contract at Cumberland Sound, the sum of \$126,500, in addition to the funds on hand, and for the maintenance of the channel to the depths and widths provided for by the present project till June 30, 1903, the sum of \$486,500.

The above assumes that the present balance of \$425,408.20 will be expended for construction. It is part of a sum appropriated for both maintenance and construction. If any or all of it be expended for maintenance the sum total of the two amounts above estimated will not be changed.

Money statement.

July 1, 1900, balance unexpended	\$547,052.47
June 30, 1901, amount expended during fiscal year	107,343.53
July 1, 1901, balance unexpended	439,708.94
July 1, 1901, outstanding liabilities	14,300.74
July 1, 1901, balance available	425,408.20
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	486,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

From 1826 up to the date of the 22-foot plan of improvement appropriations amounting to \$667,096.64 were made for the improvement of the harbor and for the removal of wrecks, as follows:

By act of Congress of—		By act of Congress of—	
March 18, 1826	\$50,000.00	August 30, 1852	\$40,000.00
March 3, 1829	24,490.00	March 3, 1855	161,000.00
July 3, 1832	25,000.00	June 10, 1872	50,000.00
March 2, 1833	43.06	March 3, 1873	50,000.00
March 2, 1833	8,430.62	February 27, 1874	193,132.96
June 28, 1834	30,000.00		
March 3, 1835	20,000.00	Total	667,096.64
July 7, 1838	15,000.00		

Under the 22-foot plan of improvement the following appropriations were made:

By act of Congress of—		By act of Congress of—	
June 23, 1874.....	\$50,000.00	August 5, 1886.....	\$150,000.00
March 3, 1875.....	70,000.00	August 11, 1888.....	180,000.00
August 14, 1876.....	62,000.00		
June 18, 1878.....	70,000.00		1,212,000.00
March 1, 1879.....	100,000.00	Unexpended balance of last	
June 14, 1880.....	65,000.00	appropriation carried to	
March 3, 1881.....	65,000.00	new project.....	4,035.05
August 2, 1882.....	200,000.00		
July 5, 1884.....	200,000.00	Total.....	1,207,964.95

Under the 26-foot plan of improvement the following appropriations have been made:

By act of Congress of—	
August 11, 1888 (unexpended balance)	\$4,035.05
September 19, 1890.....	350,000.00
July 13, 1892.....	318,750.00
March 3, 1893.....	1,000,000.00
August 18, 1894.....	975,000.00
March 2, 1895.....	856,250.00
	3,504,035.05
Amount deposited by clerk of United States circuit court for the south- ern district of Georgia, March 20, 1895.....	500.00
	3,504,535.05
Unexpended balance of last appropriation carried to modified project.....	44,485.06
Total.....	3,460,049.99

Since the existing project for improving Savannah Harbor was adopted the following appropriations have been made:

By act of Congress of—	
March 2, 1895 (unexpended balance).....	\$44,485.06
June 3, 1896.....	5,000.00
June 4, 1897.....	350,000.00
July 1, 1898.....	450,000.00
March 3, 1899.....	\$200,000.00
	50,000.00
	250,000.00
	1,099,485.06
Amount deposited to credit of the appropriation	301.41
Total.....	1,099,786.47
Grand total of appropriations	6,434,898.05

List of contracts in force.

Name and address of contractor.	Character of work.	Date of approval.	Work begun.	Expires.
George T. Warner, Savannah, Ga. a	Dredging...	Mar. 3, 1900	Mar. 28, 1900	Upon completion of the work as required by the specifications. Within 9 months from date of commencement of work.
George T. Warner, Savannah, Ga.	do.....	Nov. 12, 1900	Dec. 3, 1900	

1632 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

COMMERCIAL STATISTICS.

Cotton statistics of the port of Savannah, Ga., for the commercial year ending August 31, 1900, are as follows:

Receipts from all sources.

Grade.	Quantity.	Weight.	Value.
	<i>Bales.</i>	<i>Pounds.</i>	
Upland	1,019,634	506,594,966	\$39,939,063
Sea-island	72,250	28,697,700	4,469,385
Total	1,091,884	535,292,666	44,408,448

Exports from Savannah.

Destination.	Upland.	Sea-island.
	<i>Bales.</i>	<i>Bales.</i>
Coastwise	338,937	33,373
Great Britain	148,297	33,177
France	37,153	2,175
Other continental ports	505,197	1,082
Mill consumption and burned	450	
Reshipped to interior	417	852
Total	1,030,451	70,659

Total exports.

Grade.	Foreign ex-ports.	Coastwise exports.	Total.
	<i>Bales.</i>	<i>Bales.</i>	<i>Bales.</i>
Upland	690,647	338,937	1,029,684
Sea-island	69,807	33,373	103,180
Total	760,454	372,310	1,132,864

Steamship lines.

Line.	Steamers.	Voyages.	Freight.
			<i>Tons.</i>
Ocean Steamship Co.: Savannah to New York	6	207	375,674
Merchants and Miners' Transportation Co.: Savannah to Baltimore	8	153	258,919
Savannah to Philadelphia	2	21	25,865
Total	16	381	660,458

Cotton receipts at Savannah from 1872 to 1900.

Season Aug. 31 to Sept. 1.	Quantity.	Season Aug. 31 to Sept. 1.	Quantity.
	<i>Bales.</i>		<i>Bales.</i>
1872-73	612,794	1886-87	804,412
1873-74	630,372	1887-88	892,318
1874-75	614,478	1888-89	828,168
1875-76	523,244	1889-90	956,517
1876-77	477,435	1890-91	1,139,560
1877-78	597,449	1891-92	1,027,816
1878-79	693,764	1892-93	793,808
1879-80	741,018	1893-94	971,405
1880-81	889,383	1894-95	946,272
1881-82	737,056	1895-96	784,983
1882-83	817,760	1896-97	846,591
1883-84	655,749	1897-98	1,192,057
1884-85	728,087	1898-99	1,101,454
1885-86	803,359	1899-1900	1,091,884

Receipts of naval stores at the port of Savannah from April 1, 1883.

Season.	Spirits turpentine.		Rosin.	Season.	Spirits turpentine.		Rosin.
	<i>Casks.</i>	<i>Barrels.</i>			<i>Casks.</i>	<i>Barrels.</i>	
1883-84.....	133, 139	564, 026		1892-93.....	277, 617	1, 032, 198	
1884-85.....	117, 291	478, 834		1893-94.....	261, 080	957, 020	
1885-86.....	107, 369	450, 106		1894-95.....	268, 259	993, 164	
1886-87.....	147, 352	582, 539		1895-96.....	303, 867	1, 143, 026	
1887-88.....	169, 961	643, 532		1896-97.....	829, 445	1, 311, 050	
1888-89.....	158, 208	584, 428		1897-98.....	313, 797	1, 127, 120	
1889-90.....	183, 558	683, 077		1898-99.....	329, 466	1, 123, 942	
1890-91.....	196, 166	758, 448		1899-1900.....	309, 465	1, 076, 815	
1891-92.....	234, 986	873, 678		1900-1901.....	337, 452	1, 119, 957	

Arrivals and clearances of vessels and commerce at Savannah, Ga., from January 1, 1873, to December 31, 1900.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.			Great- est draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
1873....	463	381, 595	11, 934	34	16, 140	383	213	119, 316	2, 999	710	517, 051	15, 316	<i>Feet.</i> 17. 50
1874....	418	354, 700	10, 048	66	41, 030	487	284	182, 517	4, 232	768	578, 247	15, 127	17. 50
1875....	370	310, 887	10, 102	87	39, 832	781	222	145, 748	3, 290	659	495, 923	14, 173	17. 50
1876....	355	320, 015	10, 348	58	40, 298	987	260	160, 640	3, 865	673	530, 496	15, 200	17. 75
1877....	333	379, 826	10, 867	54	40, 948	951	287	168, 247	3, 950	674	589, 021	15, 768	18. 25
1878....	322	385, 532	10, 688	61	45, 208	576	326	235, 787	5, 814	709	666, 527	18, 078	18. 50
1879....	319	411, 794	8, 235	30	21, 994	1, 576	279	198, 400	3, 960	628	634, 828	12, 634	17. 75
1880....	338	446, 881	9, 996	14	7, 724	439	244	172, 224	3, 533	596	626, 829	13, 699	18. 33
1881....	382	508, 422	11, 069	21	10, 729	170	254	151, 463	3, 474	658	670, 614	14, 780	19. 00
1882....	391	544, 488	12, 605	11	4, 865	237	204	115, 061	2, 718	606	666, 374	16, 429	19. 00
1883....	380	468, 226	10, 659	10	4, 115	106	160	87, 020	1, 965	550	559, 366	12, 714	18. 25
1884....	388	482, 917	13, 735	14	5, 632	90	287	174, 676	3, 984	689	663, 225	17, 835	19. 00
1885....	395	493, 610	14, 622	12	5, 058	116	251	163, 321	3, 416	658	668, 989	18, 163	20. 75
1886....	393	503, 073	14, 534	10	5, 952	125	268	177, 229	3, 719	671	686, 254	18, 438	20. 00
1887....	430	543, 235	15, 127	8	2, 725	185	231	130, 136	2, 800	669	676, 096	17, 987	20. 40
1888....	411	539, 576	14, 907	8	3, 560	60	229	146, 075	3, 288	648	689, 211	18, 306	20. 67
1889....	409	561, 463	15, 547	12	6, 563	111	309	215, 865	4, 530	730	783, 891	20, 231	20. 70
1890....	483	717, 561	19, 178	9	2, 303	69	300	193, 263	4, 058	792	913, 217	23, 305	20. 00
1891....	484	719, 328	19, 014	13	4, 778	123	325	238, 123	4, 790	822	962, 229	20, 927	20. 00
1892....	449	692, 726	18, 345	6	3, 000	51	358	259, 482	5, 228	813	955, 208	23, 624	20. 00
1893....	445	667, 848	16, 970	7	2, 761	59	330	255, 632	4, 795	775	923, 480	21, 946	22. 12
1894....	445	691, 603	17, 354	6	3, 877	58	258	222, 383	4, 152	709	917, 863	21, 564	.....
1895....	467	732, 707	18, 045	5	3, 680	46	235	204, 177	3, 598	707	940, 564	21, 689	20. 07
1896....	421	697, 577	17, 502	7	4, 884	58	269	253, 754	4, 359	697	956, 215	21, 919	22. 50
1897....	442	734, 716	18, 655	8	4, 236	153	297	315, 120	5, 242	747	1, 054, 072	24, 050	23. 50
1898....	423	700, 681	17, 665	8	4, 820	143	307	316, 411	5, 229	738	1, 021, 912	23, 307	24. 00
1899....	473	784, 131	19, 614	21	9, 337	307	252	267, 911	4, 186	746	1, 061, 279	24, 107	24. 00
1900....	432	780, 601	19, 281	22	11, 725	189	260	291, 803	2, 216	714	1, 084, 139	21, 686	.....

CLEARED.

1873....	466	398, 050	13, 749	65	30, 102	669	224	129, 164	3, 194	755	557, 316	17, 632	17. 50
1874....	480	407, 295	12, 748	71	40, 397	822	229	145, 038	3, 437	780	592, 730	17, 007	17. 50
1875....	319	234, 831	9, 376	72	39, 311	804	195	128, 086	2, 924	586	452, 228	13, 404	17. 50
1876....	410	361, 999	11, 222	80	49, 483	1, 163	185	119, 699	2, 827	675	531, 781	15, 212	17. 75
1877....	400	439, 370	12, 081	65	44, 829	1, 066	161	103, 342	2, 489	626	587, 541	15, 736	18. 25
1878....	378	418, 958	10, 475	64	40, 128	1, 255	260	183, 757	5, 375	702	642, 843	17, 105	18. 50
1879....	365	442, 734	8, 834	36	24, 891	497	223	156, 470	3, 129	624	624, 095	12, 460	17. 50
1880....	310	434, 864	10, 108	26	12, 536	271	242	168, 255	3, 446	578	615, 655	13, 825	18. 33
1881....	369	508, 422	11, 458	22	13, 052	253	261	180, 579	3, 745	652	702, 053	15, 456	19. 00
1882....	350	506, 213	11, 917	23	9, 155	205	209	135, 375	3, 023	582	650, 743	15, 145	19. 00
1883....	355	415, 720	9, 780	10	4, 115	90	165	87, 400	2, 015	530	507, 235	11, 885	18. 35
1884....	360	452, 802	13, 363	15	5, 634	131	285	194, 075	4, 315	663	652, 411	17, 809	19. 00
1885....	414	502, 773	14, 672	20	8, 722	148	228	154, 858	3, 344	662	666, 353	18, 164	20. 17
1886....	378	473, 134	13, 912	3	939	24	262	194, 793	3, 970	643	668, 867	17, 906	20. 00
1887....	380	480, 030	14, 167	4	678	29	269	202, 656	4, 186	653	683, 364	18, 382	20. 00
1888....	382	507, 075	14, 231	8	2, 583	63	233	167, 836	3, 557	623	677, 494	17, 851	.....
1889....	395	540, 293	15, 505	7	1, 323	51	307	226, 181	4, 601	711	767, 747	20, 157	.....
1890....	452	663, 227	18, 815	14	4, 087	161	323	248, 013	5, 078	789	913, 327	24, 054	20. 75
1891....	445	676, 900	18, 200	4	9, 909	208	339	271, 067	5, 429	788	957, 876	23, 837	20. 75
1892....	453	685, 620	18, 235	7	1, 766	48	353	263, 166	5, 151	813	950, 252	23, 484	21. 60
1893....	411	622, 381	16, 190	9	4, 059	75	338	282, 680	5, 524	749	905, 061	21, 714	21. 75
1894....	403	636, 202	16, 425	4	1, 555	32	311	289, 882	5, 155	718	927, 639	21, 612	22. 50
1895....	412	643, 303	16, 642	2	718	21	297	303, 554	5, 220	711	947, 555	21, 883	23. 02
1896....	366	623, 966	16, 293	6	2, 763	57	311	315, 615	5, 310	683	942, 344	21, 660	23. 60
1897....	386	668, 946	17, 680	6	2, 534	55	338	373, 714	6, 137	730	1, 045, 194	23, 872	24. 00
1898....	387	648, 365	16, 902	7	3, 552	60	326	353, 326	5, 731	720	1, 005, 243	22, 693	25. 00
1899....	436	730, 568	18, 756	17	8, 420	211	281	315, 114	4, 992	734	1, 054, 102	23, 959	24. 10
1900....	432	752, 217	18, 027	10	3, 517	86	309	377, 446	5, 858	751	1, 133, 180	23, 971	24. 00

1634 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Arrivals and clearances of vessels and commerce at Savannah, Ga., etc.—Continued.

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.	Year.	Value of exports.	Value of imports.	Duties collected.
1877	\$32, 103, 853	\$36, 307, 908	\$34, 959. 93	1889	\$62, 892, 429	\$55, 062, 710	\$58, 815. 54
1878	40, 028, 988	42, 948, 465	23, 364. 35	1890	84, 584, 326	68, 229, 825	57, 542. 57
1879	40, 901, 421	43, 064, 472	27, 778. 73	1891	83, 367, 157	67, 248, 000	56, 714. 50
1880	47, 836, 411	45, 522, 480	78, 458. 41	1892	67, 211, 175	54, 119, 194	47, 687. 00
1881	58, 985, 901	48, 716, 900	356, 550. 22	1893 <i>a</i>	23, 535, 503	450, 378	56, 664. 90
1882	52, 004, 248	45, 952, 105	61, 148. 70	1894 <i>a</i>	21, 374, 516	372, 525	47, 616. 67
1883	53, 915, 934	47, 699, 796	65, 245. 34	1895 <i>a</i>	21, 690, 283	273, 305	58, 582. 49
1884	46, 425, 513	49, 112, 316	49, 147. 28	1896 <i>a</i>	22, 689, 611	349, 237	36, 149. 81
1885	48, 313, 216	49, 313, 216	45, 161. 40	1897 <i>a</i>	28, 937, 655	379, 089	46, 697. 24
1886	51, 053, 190	51, 118, 524	35, 455. 53	1898 <i>a</i>	26, 342, 891	362, 825	36, 907. 53
1887	54, 774, 082	52, 659, 223	48, 837. 12	1899 <i>a</i>	26, 077, 862	403, 350	55, 576. 73
1888	56, 435, 601	53, 412, 920	98, 213. 75	1900 <i>a</i>	49, 530, 255	512, 466	69, 453. 90

a Foreign only.JOHN H. DEVEAUX,
Collector of Customs.

N 2.

IMPROVEMENT OF SAVANNAH RIVER, GEORGIA.

Appropriations under this title have been for that portion of the river between Augusta, Ga., and Savannah, Ga.

A detailed description of the river is found in House Ex. Doc. No. 213, Fifty-first Congress, first session, and in Appendix O 2, Annual Report of the Chief of Engineers for 1890, pages 1328 and 1363.

The approved project and history of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1900, page 1928.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Work was begun by hired labor on September 1, 1900, and continued until November 30, 1900. A training dike, 520 feet long, was built at Rifle cut, and a similar dike, 545 feet long, built at Buggs bar. The dike at Half Guinea bar, begun last year, was completed. It is 700 feet long. The construction of a training dike was also begun at Blue House bar. During the fiscal year 846 piling were driven and 1,064 sawed off; 455 cross-ties spiked on; 4,676 brush bundles and 315 cubic yards of stone placed by hired labor.

On November 9, 1900, a contract was made with Albert J. Twiggs for the construction of training dikes near Augusta, Ga. Work under this contract was begun December 3, 1900. A training dike, 1,700 feet long, was built at Twiggs bar, and another, 2,000 feet long, at Rifle cut, partly constructed. Work was also carried on at Blue House bar, which had been begun by hired labor. At this point a training dike, 1,625 feet long, and two shore-protection dikes, 1,630 and 2,246 feet long, were partly built.

Under this contract 49,178 linear feet of piling, 20,377 feet B. M. of waling pieces and cross-ties, 2,150 pounds of wire spikes, 18,644 cubic yards of brush bundles, and 4,184 cubic yards of stone have been placed. Continued high water has greatly interfered with this work.

Thirty-five snags and 12 stumps were removed from the channel, 467 overhanging trees cut, and an old dam at Sand bar ferry blown out with dynamite. A houseboat, for use of bank party in cutting overhanging trees, was nearly completed. Plans for a snag boat were nearly completed.

Bids for the construction of additional training dikes and shore protection, near Augusta, were opened June 3, 1901, and the contract awarded to Hunter & Frey, of Memphis, Tenn.

CONDITION OF WORK JUNE 30, 1901.

There has been practically no low water during the past fiscal year, except for a short period in the fall. Navigation was interfered with by insufficient water at Blue House bar. This bar—the worst on the river—has now been removed. It is expected that the work now under way will permit existing boats to carry full cargoes till such time as the project depth of 5 feet is obtained.

COMMERCE AND NAVIGATION.

A detailed statement of the sources of the commerce of this river is given on page 1331 of the Annual Report of the Chief of Engineers for 1890, and on page 1504 of the same report for 1897.

During the calendar year 1900 there were four steamers engaged in the river traffic, making 144 round trips between Savannah and Augusta and carrying 45,800 tons of freight, valued at \$2,260,000.

There were also received at Savannah from this river, in small boats and lighters, 104,167 bushels of rice, valued at \$104,167.

During the same year it is estimated that 5,000,000 feet B. M. of timber was rafted down the river, valued at about \$150,000.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1900, \$69,453.90. Forts Oglethorpe, Pulaski, and Screven are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

The funds at present available will probably last until June 30, 1902. For the ensuing year funds will be required for extensive snagging and the building of such dikes and shore protection as are not constructed with the funds at present available. Just where these works will be located can not now be foretold, as the present funds will be used in improving in succession the worst bars. It is expected that the expenditure of the \$86,000 estimated for in this report will complete the project depth of 5 feet at mean low water from Savannah to Augusta.

Money statement.

July 1, 1900, balance unexpended	\$72, 006. 08
Amount appropriated by sundry civil act approved March 3, 1901	100, 000. 00
June 30, 1901, amount expended during fiscal year	172, 006. 08
	25, 923. 56
July 1, 1901, balance unexpended	146, 082. 52
July 1, 1901, outstanding liabilities	3, 361. 29
July 1, 1901, balance available	142, 721. 23
July 1, 1901, amount covered by uncompleted contracts	101, 136. 47
(Amount (estimated) required for completion of existing project	86, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended	
July 1, 1901:	
For works of improvement	\$86, 000. 00
For maintenance of improvement	10, 000. 00
	96, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project for improvement of the Savannah River, adopted in 1880, the following appropriations were made:

By act of Congress of—

March 3, 1881	\$15,000.00
August 2, 1882	25,000.00
July 5, 1884	15,000.00
August 5, 1886	15,000.00
August 11, 1888	21,000.00

91,000.00

Unexpended balance from last appropriation, carried to new project.... 19.91

Total 90,980.09

Received from other appropriations for use of snag boat..... 2,500.00

Aggregate 93,480.09

Since the existing project for improving the Savannah River was adopted, the following appropriations have been made for this work:

By act of Congress of—

August 11, 1888 (balance unexpended)	\$19.91
September 19, 1890	25,000.00
July 13, 1892	35,000.00
August 18, 1894	15,000.00
June 3, 1896	15,000.00
March 3, 1899	20,000.00
June 6, 1900	64,000.00
March 3, 1901	100,000.00

Total 274,019.91

Contract in force.

Name and address of contractor.	Character of work.	Date of approval.	Work begun.	Expires.
Albert J. Twiggs, Augusta, Ga.	Training dikes ...	Nov. 22, 1900	Dec. 3, 1900	20 months after date of commencement of work.

N 3.

IMPROVEMENT OF SAVANNAH RIVER, ABOVE AUGUSTA, GEORGIA.

The Savannah River, above the city of Augusta, is navigable only by pole boats.

A detailed description of this river is given in House Ex. Doc. No. 213, Fifty-first Congress, first session.

The history of the project and of the progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1900, page 1930.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Work was begun September 18, 1900. The dams at Little Rapid gap and at Marquarts sand bar were repaired and the channel in the

vicinity improved. In this work 222 cubic yards of rock were quarried, 6 large boulders blasted, and 203 cubic yards of stone placed in the dams. Also, 41 overhanging trees were cut and 3 large trees on bank girdled. Work ceased October 8, 1900.

CONDITION OF WORK JUNE 30, 1901.

So far as known no deterioration of the channel has taken place. About two-thirds the amount estimated for the present project has been expended. The channel is a difficult one and the process of poling boats through it is laborous. The small amount expended on it has made a decided permanent improvement.

COMMERCE AND NAVIGATION.

A detailed statement of the commerce tributary to this river is given in a report on the examination and survey of the river, printed as House Ex. Doc. No. 213, Fifty-first Congress, first session.

The freight carried on the river consists of cotton, grain, fertilizers, and general merchandise. In 1900 it amounted to about 3,192 tons, valued at \$155,000.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1900, \$69,453.90. Forts Oglethorpe, Pulaski, and Screven are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

It is proposed to use any funds that may become available during the coming fiscal year in continuing the improvement in accordance with the project, at such points as are most in need of it at the time.

Money statement.

July 1, 1900, balance unexpended	\$604. 76
June 30, 1901, amount expended during fiscal year	540. 31
July 1, 1901, balance unexpended	64. 45
{ Amount (estimated) required for completion of existing project	13, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of Savannah River above Augusta, adopted in 1879, the following appropriations were made:

By act of Congress of—

June 14, 1880	\$16, 000
March 3, 1881	8, 000
August 2, 1882	15, 000
Total	39, 000

Since the existing project for improving this portion of Savannah River was adopted the following appropriations have been made for this work:

By act of Congress of—

July 13, 1892	\$10, 000
August 18, 1894	6, 000
June 3, 1896	3, 000
March 3, 1899	1, 000
Total	20, 000

N 4.

IMPROVEMENT OF DOBOY BAR, GEORGIA.

The approved project and the history of the work will be found on page 1933 of the Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Dredging operations were carried on by Rittenhouse R. Moore, under his contract of September 1, 1899, until December 16, 1900, when the contractor suspended work. There were removed 72,666.7 cubic yards of material, making a total of 119,896.3 cubic yards removed under this contract.

CONDITION OF WORK JUNE 30, 1901.

The most of the work done by the contractor was inside and outside of the crest of the bar. But little impression was made on the bar crossing, owing to the fact that only in good weather and near high tide could any work be done, and the contractor's dredge worked very slowly on the material forming the crest. The channel dredged has shoaled badly since the contractor stopped work. It has been recommended that the contract be annulled.

MAINTENANCE.

The funds available are sufficient, at present contract prices, to complete the channel, but it will require maintenance after about June 30, 1902. A liberal estimate for this maintenance should be made, as the natural forces at work on the bar are at present very uncertain of action. The channel is in a transition stage, and nature may assist or oppose a channel on the line adopted. Forty thousand dollars should be appropriated to insure maintenance.

COMMERCE AND NAVIGATION.

The bulk of the timber passing through Darien from the Altamaha River will probably cross Doboy bar when the improvement is complete. When the timber is gone, which is a matter of comparatively a few years, the commerce will probably greatly decrease.

MISCELLANEOUS.

The work is situated in the collection district of Brunswick, Ga. Darien is the nearest port of entry. Amount of duties collected in Brunswick in 1900, \$15,869.87; at Darien, \$6,827.43. Sapelo light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven, Ga., are the nearest forts.

Money statement.

July 1, 1900, balance unexpended	\$64,319.91
June 30, 1901, amount expended during fiscal year	13,028.47
July 1, 1901, balance unexpended	51,291.44
July 1, 1901, outstanding liabilities	1,629.18
July 1, 1901, balance available	49,662.26
July 1, 1901, amount covered by uncompleted contracts.....	33,708.11
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
40,000.00	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

The first appropriation was made by act of Congress of August 5, 1886, for improving the Altamaha River, Georgia, of which \$5,795.40 was used on Doboy bar. Under the existing project of improvement an appropriation of \$70,000 for this work was made by act of Congress approved March 3, 1899.

Contract in force.

Name and address of contractor.	Character of work.	Date of approval.	Work begun.	Expires.
Rittenhouse R. Moore, Mobile, Ala...	Dredging	Oct. 4, 1899	Apr. 9, 1900	July 14, 1901

Dates of beginning and completing work changed by supplemental contract to April 1, 1900, and February 1, 1901, respectively.

COMMERCIAL STATISTICS.

For commercial statistics see report on Darien Harbor, Georgia.

N 5.

IMPROVEMENT OF DARIEN HARBOR, GEORGIA.

The approved project and the history of the work to June 30, 1900, will be found on page 1935 of the Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

No work was done during the fiscal year.

CONDITION OF WORK JUNE 30, 1901.

The wing dams are in the same condition as last year. The channel has probably shoaled to some extent. The old channel by the original Darien River to the Lower Ridge mill is still in bad condition. As three-fourths of the ships using the harbor use this old channel it should be deepened.

COMMERCE AND NAVIGATION.

The commerce of Darien consists principally of timber. A small product of rice and naval stores is shipped from that point. A daily steamer runs to Brunswick.

In 1900 the total lumber shipments from this port amounted to 116,619,999 feet B. M., valued at \$1,371,688.

MISCELLANEOUS.

The work is situated in the collection district of Brunswick, Ga. Darien is the nearest port of entry. The amount of duties collected in 1900 in Brunswick was \$15,869.87; at Darien, \$6,827.43. Sapelo light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

It is estimated that \$15,000 can be economically and advantageously expended during the fiscal year ending June 30, 1902, for the improvement of this waterway, which expenditure is urgently needed. It is also estimated that \$5,000 will serve for its maintenance during the fiscal year ending June 30, 1903.

It is proposed to expend any funds that may become available in dredging the original channel to the Lower Ridge mill and in removing shoals in the river between Darien wharf and the "Break."

Money statement.

July 1, 1900, balance unexpended	\$966.58
June 30, 1901, amount expended during fiscal year	956.12
July 1, 1901, balance unexpended	10.46
{ Amount (estimated) required for completion of existing project	65,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement	\$15,000.00
For maintenance of improvement	5,000.00
	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

The first appropriation, \$8,000 (which was expended in dredging), was made by act of Congress of June 18, 1878.

Under the existing project of improvement the following appropriations have been made for this work:

By act of Congress of—	
September 19, 1890	\$25,000
July 13, 1892	25,000
August 18, 1894	25,000
June 3, 1896	20,000
March 3, 1899	10,000
Total	105,000
Grand total	113,000

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Darien, Ga., from January 1, 1875, to December 31, 1900.

ARRIVED.

Year.	Coastwise.			Foreign ports.									Greatest draft.
				American vessels.						Foreign vessels.				Total.
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
1875.....	77	28,053	677				92	47,600	1,198	169	75,663	1,845	<i>Fect.</i> 22
1876.....	65	23,105	611				124	70,368	1,897	189	93,473	2,508	21
1877.....	104	24,827	1,257	3	671	22	99	50,913	1,231	206	106,414	2,510	20
1878.....	61	29,264	641	2	1,051	20	126	60,109	1,628	189	90,424	2,289	20
1879.....	58	23,275	487	3	4,199	25	115	57,710	1,407	176	82,184	1,919	19½
1880.....	66	21,539	489	1	688	13	134	68,072	1,608	201	90,270	2,140	19½
1881.....	101	40,619	849	3	1,220	29	162	84,457	1,991	166	126,295	2,869	19½
1882.....	117	48,208	999	1	455	9	90	51,421	1,155	208	100,082	2,163	19
1883.....	95	38,173	815				93	49,290	1,135	188	87,963	1,950	19
1884.....	81	34,412	714	2	606	16	92	50,178	1,133	175	85,193	1,863	19
1885.....	78	27,763	691	2	652	16	80	42,587	975	160	71,002	1,673	18½
1886.....	108	44,389	852				42	20,772	483	150	65,161	1,335	19
1887.....	127	57,035	1,059	5	2,349	45	26	13,023	298	158	72,407	1,402	.....
1888.....	185	76,645	1,558	1	402	9	22	13,423	273	208	91,470	1,840	18½
1889.....	145	69,763	1,341	7	4,349	62	61	19,837	453	213	93,949	1,856	13½
1890.....	169	58,058	1,158	5	1,964	41	28	10,860	308	202	70,222	1,507	18½
1891.....	137	56,818	1,124	6	2,377	46	24	17,853	308	167	77,048	1,478	.....
1892.....	168	69,627	1,369	1	353	7	25	17,446	334	194	87,426	1,710	18½
1893.....	134	58,310	1,076	4	1,918	33	33	31,417	486	121	91,640	1,595	18½
1894.....	81	39,158	653	3	1,215	23	58	52,751	852	142	95,124	1,528	17
1895.....	131	65,317	1,121	3	1,228	23	46	44,213	702	180	110,668	1,846	17
1896.....	92	42,024	717	1	342	8	55	53,499	876	148	95,523	1,591	.....
1897.....	86	45,740	821	7	2,782	54	97	94,678	1,473	190	143,200	2,348	.....
1898.....	44	18,347	333	5	2,070	38	108	108,599	1,417	161	129,016	1,788	.....
1899.....	51	27,621	435	6	2,302	46	73	74,116	1,027	130	104,039	1,508	17
1900.....	68	36,980	597	3	1,872	30	107	105,781	1,565	178	144,633	2,192	.....

CLEARED.

														<i>Fect.</i>
1875.....	22	12,214	328	11	4,055	97	104	55,759	1,372	137	72,028	1,796	22	
1876.....	39	9,300	270	4	1,553	32	180	87,489	2,263	223	98,342	2,565	21	
1877.....	44	13,209	314	4	842	21	169	92,795	2,154	217	106,846	2,489	20	
1878.....	28	7,842	181	6	3,000	62	149	83,385	1,947	183	94,236	2,190	20	
1879.....	40	14,052	301	7	2,765	57	125	56,433	1,538	172	82,250	1,896	19½	
1880.....	55	17,076	393	7	3,589	72	168	84,172	2,016	230	104,817	2,481	19½	
1881.....	80	28,492	617	8	3,120	70	184	95,353	2,164	272	126,965	2,851	19½	
1882.....	93	34,098	709	6	1,962	46	115	63,525	1,434	214	99,585	2,189	19	
1883.....	66	25,019	510	9	3,533	72	108	56,411	1,340	183	84,963	1,931	19	
1884.....	59	20,637	457	11	3,977	85	119	66,337	1,478	189	90,951	2,020	19	
1885.....	46	16,649	339	8	3,354	62	98	52,742	1,198	152	72,745	1,599	18½	
1886.....	93	38,295	719	10	3,682	80	50	24,376	564	153	66,358	1,363	19	
1887.....	126	55,592	1,016	12	1,144	17	16	8,612	189	144	65,700	1,222	.....	
1888.....	155	64,749	1,318	2	538	15	36	23,742	453	193	89,029	1,786	19	
1889.....	155	63,347	2,091	6	4,333	66	46	26,488	528	207	94,168	2,685	.....	
1890.....	171	58,810	1,174	3	962	23	31	15,569	336	205	75,351	1,533	.....	
1891.....	127	53,890	1,031	3	896	20	26	18,006	256	156	72,792	379	.....	
1892.....	161	69,488	1,310	2	917	16	33	21,502	418	196	91,807	1,744	.....	
1893.....	137	56,297	1,115	1	300	6	46	40,150	630	184	96,747	1,751	.....	
1894.....	75	33,478	583	1	479	8	61	57,772	894	137	91,689	1,485	17	
1895.....	124	55,829	970	1	817	16	53	51,599	818	178	108,245	1,804	17	
1896.....	93	41,900	705	.....	.....	.....	62	59,594	926	155	101,494	1,631	.....	
1897.....	80	23,750	593	.....	.....	.....	95	94,742	1,500	175	128,497	2,093	.....	
1898.....	43	16,753	318	1	413	8	108	109,743	1,651	152	126,999	1,977	.....	
1899.....	49	21,022	344	.....	.....	.....	88	91,964	1,288	137	112,986	1,632	17	
1900.....	68	34,339	557	1	1,117	16	100	102,226	1,473	169	137,682	2,046	.....	

1642 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Timber shipments from port of Darien, Ga., from January 1, 1875, to December 31, 1900.

Year.	Foreign.		Coastwise.		Total.	
	Superficial feet.	Value.	Superficial feet.	Value.	Superficial feet.	Value.
1875	41, 447, 024	\$557, 524	10, 992, 600	\$181, 377	52, 439, 624	\$738, 901
1876	60, 762, 000	735, 099	8, 370, 000	138, 105	69, 132, 000	873, 204
1877	64, 378, 000	776, 856	11, 888, 100	196, 153	76, 266, 100	973, 010
1878	59, 697, 124	716, 365	7, 057, 800	116, 454	66, 754, 924	832, 819
1879	47, 217, 818	566, 613	12, 646, 800	208, 672	59, 864, 618	775, 285
1880	74, 612, 520	895, 350	15, 368, 500	253, 579	89, 981, 020	1, 148, 929
1881	65, 420, 876	785, 050	25, 642, 800	423, 106	91, 063, 676	1, 208, 156
1882	36, 639, 379	439, 672	30, 688, 200	506, 355	67, 327, 579	946, 027
1883	42, 385, 000	508, 620	22, 517, 100	371, 532	64, 902, 100	880, 152
1884	50, 656, 000	607, 872	18, 573, 300	306, 459	69, 229, 300	914, 331
1885	40, 101, 000	501, 262	14, 984, 100	247, 938	55, 085, 100	749, 200
1886	19, 960, 000	219, 500	24, 465, 000	661, 440	54, 425, 000	870, 940
1887	12, 023, 611	138, 476	50, 349, 600	912, 220	62, 373, 211	1, 056, 960
1888	17, 975, 371	215, 705	65, 998, 200	1, 121, 960	83, 975, 571	1, 337, 665
1889	20, 772, 265	237, 652	50, 667, 660	760, 144	71, 449, 865	997, 816
1890	10, 962, 017	140, 746	68, 223, 683	949, 762	79, 185, 700	1, 090, 508
1891	13, 785, 333	274, 674	45, 519, 707	910, 718	59, 305, 040	1, 185, 392
1892	12, 893, 730	179, 616	49, 708, 879	1, 093, 595	62, 602, 609	1, 273, 211
1893	33, 300, 000	399, 600	41, 375, 100	827, 502	74, 675, 100	1, 227, 102
1894	47, 910, 319	583, 671	30, 094, 750	571, 789	78, 004, 519	1, 155, 460
1895	39, 602, 963	426, 451	44, 660, 000	803, 880	84, 262, 963	1, 228, 331
1896	43, 059, 139	461, 148	34, 150, 251	341, 502	77, 209, 390	802, 650
1897	74, 170, 144	763, 557	27, 000, 000	324, 000	101, 170, 144	1, 087, 557
1898	90, 267, 216	1, 783, 326	6, 980, 688	575, 057	97, 347, 904	2, 358, 383
1899	71, 814, 048	783, 442	11, 411, 666	136, 940	83, 215, 714	920, 382
1900	94, 943, 972	1, 111, 576	21, 676, 027	260, 112	116, 619, 999	1, 371, 688

Commerce.

Year.	Value of exports.	Value of imports.	Total collections.
1880	\$1, 621, 904	\$5, 600	\$11, 806. 72
1881	1, 137, 490	3, 356	18, 980. 02
1882	1, 073, 008	1, 025	11, 254. 19
1883	969, 834	2, 334	11, 067. 37
1884	1, 038, 185	11	9, 688. 20
1885	860, 500		2, 359. 01
1886	1, 037, 330		1, 716. 46
1887	1, 221, 000		1, 060. 97
1888	2, 100, 000	2, 600	964. 13
1889	997, 816		1, 784. 03
1890	140, 746		968. 95
1891	1, 530, 000		1, 198. 28
1892	1, 452, 827		1, 500. 85
1893	1, 406, 718		1, 930. 21
1894	804, 972		3, 516. 70
1895	1, 228, 000		2, 631. 24
1896	802, 651		3, 353. 93
1897	1, 087, 557		6, 060. 88
1898	1, 783, 326		6, 834. 15
1899	920, 382		5, 214. 99
1900	1, 374, 688		6, 827. 43

JOHN C. LAWTON,
Collector of Customs.

N 6.

IMPROVEMENT OF ALTAMAHA RIVER, GEORGIA.

A detailed description of this river is given in Appendix O, Annual Report of the Chief of Engineers for 1890, pages 1327-1386.

The approved project and the report of progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1900, page 1939.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

The spur dams and training dike at Couper's bar were repaired, in which work 4,532 bundles of brush and 151 cubic yards of stone were used. One hundred and ninety-five cubic yards of rock were quarried for use in completing training dike at Griner's bar. Ninety-nine snags and 18 stumps were removed from the channel, 609 overhanging trees and 32 logs cut on bank, and 133 trees on bank girdled. A small pile driver and 2 small barges were constructed for work on this river.

CONDITION OF WORK JUNE 30, 1901.

There has been practically no low water during the past fiscal year, so the condition of the channel is not known. The shoal at Beard's bluff has probably become worse. Several other shoals will doubtless need removing, and there are many snags in the river.

COMMERCE AND NAVIGATION.

The principal items of commerce of the river are timber and naval stores and the merchandise necessary to supply the camps of the producers of those articles.

During the calendar year 1900, 162,000,000 feet B. M. of timber were rafted down the river, valued at about \$1,920,000. The majority of this timber came from the Oconee and Ocmulgee rivers and was rafted down the Altamaha to mills at Darien and vicinity. Thirty-seven million nine hundred and sixty thousand feet, valued at about \$452,000, originated on the Altamaha.

There were also handled about 15,000 tons of freight, valued at about \$1,025,000.

One steamer plies the river between Doctortown and the Forks, making two round trips per week; one between Doctortown and Jacksonville, on the Ocmulgee, making one round trip per week; and another between Doctortown and Abbeville, on the Ocmulgee, making one round trip per week.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1900, \$15,869.87. Sapelo light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

It is proposed to expend any funds that may become available during the coming fiscal year in the removal of obstructions and the improvement of the shoal places in the river according to the project of 1890.

The sum of \$30,000 can be economically and advantageously expended during the coming year. No permanent improvement can be effected, as new obstructions, caused by logs and snags, form during every freshet stage. They should, however, diminish in number from year to year.

A large appropriation was made June 6, 1900, for the improvement of the Ocmulgee River. This will be of local benefit only unless the Altamaha is improved to an equal degree.

The next work done on this river should be to improve the very bad conditions at Beard's bluff, remove the rock shoals at Cypress Nursery

and Carter's bight, clear the river of snags, and remove as many of the worst sand bars as the funds available will permit.

Money statement.

July 1, 1900, balance unexpended	\$3,242.16
Amount allotted from emergency river and harbor act.....	9,000.00
	12,242.16
June 30, 1901, amount expended during fiscal year	10,369.09
July 1, 1901, balance unexpended	1,873.07
July 1, 1901, outstanding liabilities	11.25
July 1, 1901, balance available	1,861.82
{ Amount (estimated) required for completion of existing project.....	104,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
{ For works of improvement.....	\$30,000.00
{ For maintenance of improvement	8,000.00
	38,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of the Altamaha River, adopted in 1880, the following appropriations were made:

By act of Congress of—	
March 3, 1881	\$5,000.00
August 2, 1882	15,000.00
July 5, 1884	20,000.00
August 5, 1886	20,000.00
August 11, 1888	10,000.00
	70,000.00
Unexpended balance of last appropriation carried to new project	223.41
Total	69,776.59

Since the existing project for improving Altamaha River was adopted in 1890 the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	\$223.41
September 19, 1890	15,000.00
July 13, 1892	15,000.00
August 18, 1894	10,000.00
June 3, 1896	10,000.00
March 3, 1899	6,000.00
June 6, 1900 (allotted from emergency appropriation)	9,000.00
Total	
	65,223.41
Grand total	
	135,000.00

N 7.

IMPROVEMENT OF OCONEE RIVER, GEORGIA.

A detailed description of this river is given in House Ex. Doc. No. 211, Fifty-first Congress, first session.

The approved project and the history of the work to June 30, 1900, will be found on page 1942 of the Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

A training dike at Bonny Clabber Cut-off was begun on December 14, 1900, and at the close of the fiscal year was partly completed. In connection with this dike 219 piling were driven, 2,100 bundles of brush placed, and a large quantity of additional material prepared.

Four hundred and fifty-two snags and 77 stumps were removed from the channel and 8 logs and 2,615 overhanging trees cut on bank.

CONDITION OF WORK JUNE 30, 1901.

The river is full of snags. There are several rock shoals and sand bars for whose removal the project calls. The breach in the old dam at Fish Trap Cut needs widening.

COMMERCE AND NAVIGATION.

The Oconee River is navigable from the mouth to Milledgeville. During the year 1900 the steamers plying the river handled 6,800 tons of freight, valued at \$524,000. In addition to this there were rafted down the river during the same year 86,397,623 feet B. M. of timber, valued at about \$1,001,629. Excepting the timber traffic the commerce of the river is carried on in detached segments tributary to the railroads crossing the river.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1900, \$15,869.87. Sapelo light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

It is proposed to expend any funds that may become available during the coming fiscal year in the removal of obstructions and the improvement of the shoal places in the river according to the project of 1890.

Forty thousand dollars can be economically and advantageously expended the first season after funds are appropriated in putting this river in condition to be used by boats with reasonable safety and make the forests of timber adjacent to it available for market at reasonable expense.

Money statement.

July 1, 1900, balance unexpended.....	\$2, 217. 03
Amount allotted from emergency river and harbor act.....	3, 100. 00
	5, 317. 03
July 30, 1901, amount expended during fiscal year.....	4, 654. 61
July 1, 1901, balance unexpended.....	662. 42
July 1, 1901, outstanding liabilities.....	339. 19
July 1, 1901, balance available.....	323. 23
{ Amount (estimated) required for completion of existing project.....	127, 900. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$40, 000. 00
For maintenance of improvement.....	8, 000. 00
	48, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the works of improvement were begun the following appropriations have been made:

By act of Congress of—		By act of Congress of—	
June 18, 1878.....	\$10,000.00	July 5, 1884.....	\$3,000.00
March 3, 1879.....	1,500.00	August 5, 1886.....	9,000.00
June 14, 1880.....	1,500.00	Aug. 11, 1888.....	12,500.00
March 3, 1881.....	2,500.00		
August 2, 1882.....	5,000.00		45,000.00
Unexpended balance from last appropriation carried to new project			201.18
Total			44,798.82

Since the existing project for improving the Oconee River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance).....	\$201.18
September 19, 1890.....	25,000.00
July 13, 1892.....	25,000.00
August 18, 1894.....	10,000.00
June 3, 1896.....	10,000.00
March 3, 1899.....	10,000.00
June 6, 1900 (allotted from emergency appropriation)	3,100.00
Total	83,301.18
Grand total	128,100.00

N 8.

IMPROVEMENT OF OCMULGEE RIVER, GEORGIA.

A detailed description of this river is found in House Ex. Doc. No. 215, Fifty-first Congress, first session.

The approved project and the history of the work to June 30, 1900, will be found on page 1944 of the Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Work was continued on this river throughout the fiscal year.

The snag boat began operations at a point about 15 miles above the mouth, this lower stretch having been thoroughly cleaned of snags the previous year. This work was continued upstream to a point near Jacksonville, about 50 miles from the mouth, thoroughly cleaning this portion of the stream. During the high water in the winter the boat worked in the upstream portions of the river near Macon. During the year 3,229 snags and 305 stumps were removed from the channel, 11,933 overhanging trees and saplings and 89 logs cut on the banks, and 52 trees girdled.

Quinn shoals, a rock ledge about 8 miles from the mouth of the river, was entirely removed, and a clay point at Hubbard's shoals, about 12 miles from the mouth of the river, was blasted off.

The following training dikes were built to remove sand bars: One at McRae's bar, 1,200 feet long, was completed; another at Dent's

landing, 460 feet long, was completed; another at Mobley's bluff, 1,100 feet long, was completed; another at Davis's reach, 1,850 feet long, was partially completed. For this latter the piling is all driven and all the material, except rock, was ready for its completion. Another at Mitchell's bar, 350 feet long, is in about the same condition. These dikes are all between Hawkinsville and Lumber City.

Above Hawkinsville, and near Macon, a dike, 380 feet long, at Red bluff, was completed. At Mansfield's bar there are three dikes, one 840 feet, one 552 feet, and one 540 feet long, the latter being driven for a shore protection. These are all completed, except cross-ties, sawing off piling, etc., which can not be done except at low water.

At the bars just below Macon there are four dikes, one 1,060 feet, one 2,875 feet, one 482 feet, and one 1,951 feet long. These are nearly completed; the same as those at Mansfield's bar.

In the construction of these dikes, during the fiscal year there were 2,473 piling driven, 2,696 brush bundles, and 1,198 cubic yards of stone used. Seven hundred and thirty-one linear feet of brush mattresses were also made and placed alongside the dikes.

The cut-offs at Gee's point and Cow Face bar were partly opened, in which work 932 snags and 31 stumps were removed, 1,918 overhanging trees, and 1,640 logs cut on bank, and the cuts cleared of brush.

The construction of a house boat for use of bank party in cutting overhanging trees was begun.

CONDITION OF WORK JUNE 30, 1901.

At the close of the fiscal year the navigable depth of the project appears to be obtained between the mouth of the river and Hollingsworth ferry, 72 miles from the mouth, and the river is in first-class condition in all respects between the mouth and Jacksonville, 50 miles from the mouth. Between Hollingsworth Ferry and Hawkinsville, 133 miles from the mouth, two dikes must be completed and a third one built before the navigable depth of the project will be obtained. Between Jacksonville and Hawkinsville, which is a distance of 83 miles, the river is full of snags. Between Hawkinsville and Macon, 202 miles from the mouth, the navigable depth is apparently obtained at all points, except Westlake bar and the rock shoals above Hawkinsville. Westlake bar will require a dike, and the rock shoals above Hawkinsville will require removal, an operation of considerable magnitude. The river between Hawkinsville and Macon also has only been partially snagged.

COMMERCE AND NAVIGATION.

A detailed discussion of this subject will be found on pages 1478 to 1484 of the Report of the Chief of Engineers for 1890, and page 1520 of the same report for 1897.

At present there is no navigation at all between Macon and Hawkinsville, except that one small steamer occasionally goes to Macon.

Five steamers are engaged in the river traffic, running as follows: One between Hawkinsville and Jacksonville, making one round trip per week; one between Hawkinsville and Abbeville, making two round trips per week; one between Abbeville and Doctortown, on the Altamaha, making one round trip per week; one between Lumber

City and Wilcox Old Lake, making three round trips per week, and one between Doctortown, on the Altamaha, and Jacksonville, making one round trip per week. During the calendar year 1900 there were handled by these boats 24,724 tons of freight, valued at about \$1,310,000. There were also rafted down the river 54,000,000 feet B. M. of timber, valued at about \$598,000.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1900, \$15,869.87. Sapelo light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

The funds now available will be expended in the completion of dike work at Macon bar, Mansfield's bar, Mitchell's bar, Davis's reach, Hollingsworth Ferry, and Westlake bar; in completing the cut-offs at Gee's point and Cow Face bar; the removal of part of the rock shoals above Hawkinsville, and in snagging operations. These funds will carry on operations until June 30, 1902. For the ensuing fiscal year provision should be made for the construction of a snag boat, at an estimated cost of \$24,000, and for the expenditure of about \$32,000 in removing the extensive rock shoals above Hawkinsville.

Money statement.

July 1, 1900, balance unexpended.....	\$41,052.78
Amount appropriated by sundry civil act approved March 3, 1901	40,000.00
	81,052.78
June 30, 1901, amount expended during fiscal year	33,824.71
July 1, 1901, balance unexpended.....	47,228.07
July 1, 1901, outstanding liabilities.....	2,655.45
July 1, 1901, balance available	44,572.62
{ Amount (estimated) required for completion of existing project.....	56,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$56,000.00
For maintenance of improvement.....	10,000.00
	66,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Upon the original project of improvement of the Ocmulgee River, adopted in 1876, the following appropriations were made:

By act of Congress of—

August 14, 1876	\$15,000.00
June 18, 1878	15,000.00
March 3, 1879	7,000.00
June 14, 1880	7,000.00
March 3, 1881	5,000.00
August 2, 1882	5,000.00
July 5, 1884	3,000.00
August 5, 1886	7,500.00
August 11, 1888	15,000.00
	79,500.00
Unexpended balance carried forward from last appropriation to new project	224.95
Total	
	79,725.05

Since the existing project for improving Ocmulgee River was adopted the following appropriations have been made for the work:

By act of Congress of—

August 11, 1888 (unexpended balance)	\$224. 95
September 19, 1890.....	30,000. 00
July 13, 1892.....	25,000. 00
August 18, 1894	10,000. 00
June 3, 1896	10,000. 00
March 3, 1899.....	20,000. 00
June 6, 1900	40,000. 00
March 3, 1901.....	40,000. 00
Total.....	175,224. 95
Total, all appropriations.....	254,500. 00

N 9.

IMPROVEMENT OF BRUNSWICK HARBOR, GEORGIA.

The approved project and the history of the work to June 30, 1900, will be found on page 1948 of the Report of the Chief of Engineers for 1900.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Dredging operations were begun July 2, 1900, by P. Sanford Ross, incorporated, under contract dated August 21, 1899, and continued until October 30, 1900, when the contract was completed; 63,644.6 cubic yards of material were removed.

CONDITION OF WORK JUNE 30, 1901.

The jetty is unchanged from last year. The present depth over the shoal is 15 feet at mean low water.

COMMERCE AND NAVIGATION.

Information in regard to the commerce of Brunswick before the improvement will be found on page 1523 of the Report of the Chief of Engineers for 1897. Since 1880 the annual tonnage of the port and its value have grown very much, the shipments of cotton, for instance, having increased from 4,000 bales in 1885 to 200,541 in 1897.

Besides two lines of steamers to New York and boats to points in Georgia and Florida, a large fleet of foreign and coastwise steam and sailing vessels is engaged in the Brunswick trade, which consists principally of shipments of cotton, naval stores, lumber, ties, and phosphates.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1900, \$15,869.87. St. Simons light is the nearest light-house, and Fort Clinch, Fla., the nearest fort.

The river and harbor act of March 3, 1899, provided for an examination and survey of Brunswick, Ga., outer bar, with plan and estimate of cost thereof, with a view to obtaining a depth of 26 feet, at mean high tide, with a width of 200 feet.

The report of the examination and survey made in compliance with the above is printed as House Ex. Doc. No. 355, Fifty-sixth Congress, second session.

To maintain the channel in this harbor, including the dredged channel at the mouth of Academy Creek, until June 30, 1902, it is estimated that \$10,000 will be required. For the year ending June 30, 1903, it is estimated that an additional \$10,000 will be required, unless funds are appropriated in the meantime for the removal of the shoal below the city, in accordance with the recommendations printed in House Ex. Doc. No. 40, Fifty-sixth Congress, first session (p. 1962, Annual Report of Chief of Engineers for 1900), in which case no funds for maintenance will be required.

Money statement.

July 1, 1900, balance unexpended	\$9,431.40
June 30, 1901, amount expended during fiscal year	9,184.34
July 1, 1901, balance unexpended	247.06
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the work of improvement was begun the following appropriations have been made:

By act of Congress of—		By act of Congress of—	
July 4, 1836.....	\$10,000	August 5, 1886	\$22,500
March 3, 1879.....	20,000	August 11, 1888	35,000
June 14, 1880	10,000	September 19, 1890	35,000
March 3, 1881	5,000	July 13, 1892.....	27,500
August 2, 1882	25,000		
July 5, 1884.....	10,000	Total	200,000
For maintenance:			
August 18, 1894			10,000
June 3, 1896			15,000
March 3, 1899			10,000
Aggregate			235,000

Contract in force.

Name and address of contractor.	Character of work.	Date of approval.	Work begun.	Expires.
P. Sanford Ross, Incorporated, Jersey City, N. J. a	Dredging ...	Sept. 26, 1899	July 2, 1900	Upon completion of the work as required by the specifications.

COMMERCIAL STATISTICS.

Exports.

Articles.	Foreign.	Domestic (coastwise).	Articles.	Foreign.	Domestic (coastwise).
Cotton bales.	89,565	36,973	Staves number..	2,400	9,017,000
Cotton-seed meal, tons..	597	50	Shingles..... do...	917,800	.....
Cotton seed do.	4,022	.....	Ties do.....	50,541	2,131,173
Cotton-seed oil cakes,	.....	.....	Pig iron tons...	11,790	553
tons	608	.....	Phosphate..... do...	9,040	.....
Cotton-seed hulls, tons.	.....	.....	Tar barrels.....	.....	.....
Linters bales.	156	917	Merchandise tons..	10	25
Gasoline gallons.	.....	.....	Laths bundles.....	20,400	.....
Cotton-seed oil, barrels..	.....	3,439	Hay bales.....	20	.....
Rosin do.....	174,301	40,706	Horses number.....	.....	.....
Turpentine do.....	53,979	26,768	Sirup barrels.....	.....	300
Machine oil do.....	.....	.....	Yarns bales.....	.....	27,048
Lumber and timber,	.....	.....	Sheeting do.....	.....	500
feet.....	36,770,000	143,437,000	Straw do.....	.....	.....

Exports and imports.

	Tons.	Value.
Exports, domestic (coastwise) and foreign	689,228	\$15,131,373
Imports	44,771	9,574,370
Total	733,999	24,705,743

Steamship lines.

Line.	Steamers.	Voyages.	Freight.
Mallory Steamship Line: Brunswick to New York	4	52	<i>Tons.</i> 153,000
The Clyde Line: Brunswick to New York and Boston	4	48	89,535
Total	8	100	242,535

Arrivals and clearances of vessels and commerce at Brunswick, Ga., from January 1, 1878, to December 31, 1900.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878	116	32,584	850	36	10,218	270	41	19,008	493	193	61,810	1,613
1879	148	44,397	1,000	33	8,235	232	40	17,589	468	221	70,221	1,790
1880	271	77,656	1,891	36	11,219	317	39	14,996	432	346	103,871	2,641
1881	279	100,451	2,239	13	4,174	98	63	30,279	751	355	134,904	3,088
1882	335	123,149	2,659	7	2,095	57	63	26,958	694	405	152,202	3,416
1883	299	110,302	2,368	11	4,814	107	87	40,765	979	397	155,881	3,454
1884	239	88,063	1,893	10	4,434	88	126	62,818	1,435	375	155,315	3,416
1885	242	93,280	1,928	10	3,216	76	94	43,284	1,037	346	139,780	3,052
1886	229	88,244	1,751	7	3,262	48	98	47,798	1,164	334	139,304	2,835
1887	194	86,731	1,625	8	2,251	116	102	54,537	1,232	304	144,519	2,973
1888	821	290,590	3,619	9	2,991	76	147	80,330	1,729	977	373,911	10,424
1889	220	92,831	1,764	29	10,035	176	191	113,757	2,403	431	216,623	4,343
1890	316	196,701	3,844	23	7,513	186	126	71,158	1,559	465	275,372	5,589
1891	374	235,565	5,462	29	8,025	164	107	70,228	1,523	501	313,818	6,149
1892	439	279,998	4,450	42	20,548	354	134	85,332	1,812	615	385,878	6,616
1893	431	255,367	4,392	48	23,384	371	123	93,634	1,710	602	372,385	6,473
1894	382	261,315	4,926	50	25,382	393	173	147,672	2,675	605	434,369	7,991
1895	481	319,399	5,750	25	14,867	242	147	112,957	2,089	653	447,233	8,081
1896	587	344,045	6,503	40	19,999	359	134	63,348	1,852	761	427,392	8,714
1897	716	417,847	7,783	84	42,543	717	260	232,762	4,158	1,060	693,143	12,658
1898	767	406,088	6,701	49	28,278	456	246	262,431	4,299	1,062	696,797	11,456
1899	386	316,024	5,954	57	29,466	478	123	101,472	1,837	566	446,962	8,269
1900	458	383,160	6,609	39	23,945	388	143	109,346	2,132	640	516,451	9,129

1652 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Arrivals and clearances of vessels and commerce at Brunswick, Ga., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878	124	32,767	874	28	9,231	236	49	21,218	550	201	63,216	1,660
1879	157	42,345	1,116	21	7,172	172	47	21,730	555	225	71,247	1,813
1880	270	78,913	2,010	14	5,010	115	48	19,970	550	332	103,900	2,675
1881	252	82,155	1,732	17	7,218	156	87	42,659	1,014	356	132,932	1,902
1882	278	96,170	2,086	19	7,761	170	101	48,699	1,139	398	152,630	3,395
1883	257	91,036	1,962	28	11,268	240	121	55,717	1,369	411	158,021	3,571
1884	176	62,927	1,322	38	16,209	335	148	70,612	1,633	362	149,478	3,290
1885	196	71,345	1,481	21	8,696	190	135	62,437	1,456	352	142,478	3,127
1886	184	67,020	1,413	17	7,528	159	117	56,280	1,305	318	130,828	2,877
1887	130	51,305	958	5	5,858	143	121	72,894	1,526	276	130,057	2,627
1888	785	266,152	8,240	13	4,715	116	173	102,300	2,236	971	373,227	10,592
1889	169	65,809	1,273	11	4,266	103	221	130,919	2,830	401	200,994	4,206
1890	247	122,820	2,024	18	8,745	165	172	107,197	2,261	437	238,762	4,450
1891	313	186,171	3,432	26	16,045	234	141	94,827	1,960	480	297,043	5,646
1892	390	247,329	4,228	19	6,882	174	163	109,728	2,334	572	363,939	6,736
1893	420	236,856	4,165	13	6,857	121	159	119,282	2,266	590	362,995	6,552
1894	363	235,307	4,431	14	6,081	125	223	193,483	3,260	600	434,871	7,886
1895	458	290,702	5,260	9	4,155	103	182	148,892	2,811	649	443,749	8,174
1896	591	323,357	5,759	18	8,638	173	150	112,446	2,248	759	444,441	8,180
1897	764	432,089	6,940	15	6,155	117	274	246,302	4,326	1,053	684,546	11,383
1898	769	406,016	6,255	12	6,028	99	255	265,381	4,371	1,036	677,425	10,725
1899	423	339,884	5,738	12	4,595	90	148	133,844	2,315	583	478,323	8,143
1900	491	405,180	6,616	11	5,916	90	143	111,817	2,107	635	512,913	8,813

COMMERCE.

Year.	Value of exports.	Value of imports.	Total collection.	Year.	Value of exports.	Value of imports.	Total collection.
1878	\$1,372,842	\$400	\$4,500.97	1890	\$7,355,841	\$7,326	\$5,748.00
1879	1,394,401	3,197	5,644.33	1891 a	9,742,553	3,014,207	5,982.07
1880	1,702,570	8,098	17,723.27	1892	5,372,775	22,988	6,408.15
1881	2,230,000	4,377	29,305.30	1893 a	7,297,973	1,680,512	5,768.00
1882	1,700,000	2,734	20,058.90	1894 a	9,940,453	3,549,378	9,141.41
1883	3,437,000	3,093	24,911.61	1895 a	7,520,404	3,328,407	7,422.10
1884	3,500,000	958	19,780.32	1896	5,727,074	15,072	8,047.11
1885	3,063,960	4,008	3,939.27	1897 a	12,582,114	5,803,110	18,586.57
1886	2,828,656	2,397	5,834.43	1898 a	15,259,533	6,995,941	23,080.00
1887 a	4,121,660	2,815,769	37,520.00	1899 a	12,190,398	8,989,797	8,798.25
1888 a	7,552,025	3,140,231	7,438.04	1900 a	15,131,373	9,574,370	15,869.87
1889	7,894,281	6,557	8,933.66				

a Coastwise and foreign.

Statement of receipts of naval stores.

Year.	Rosin.	Spirits.	Year.	Rosin.	Spirits.
	Barrels.	Barrels.		Barrels.	Barrels.
1880	36,495	5,661	1891	161,402	42,697
1881	67,562	13,490	1892	220,250	52,496
1882	104,357	23,459	1893	172,412	43,100
1883	80,078	16,105	1894	187,912	46,954
1884	105,622	23,449	1895	268,349	53,329
1885	92,958	30,900	1896	259,103	66,286
1886	139,366	34,625	1897	323,155	77,441
1887	125,546	32,338	1898	245,311	71,459
1888	140,820	37,643	1899	299,743	75,405
1889	186,000	45,000	1900	275,007	87,747
1890	212,374	42,813			

HENRY T. DUNN, *Collector of Customs.*

N 10.

IMPROVEMENT OF THE INSIDE WATER ROUTE BETWEEN SAVANNAH,
GEORGIA, AND FERNANDINA, FLORIDA.

The description of this route, the project for its improvement, and the progress of the work to June 30, 1900, will be found in the Report of the Chief of Engineers for 1900, page 1953.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

No work was done during the fiscal year.

CONDITION OF WORK JUNE 30, 1901.

There has been no particular change in the conditions during the past year. The long route through Parsons cut, or Romerly marshes, is a great impediment to navigation, most of the boats that can do so seeking shorter routes through the marshes by way of small sloughs. This part of the route could be much improved by the opening of a new channel. The enormous timber traffic from the Altamaha River to Sapelo Sound is very badly hampered by the shoals in Mud River.

COMMERCE AND NAVIGATION.

For a detailed discussion of the commerce over the inside route see pages 1323 and 1324 of the Annual Report of the Chief of Engineers for 1892; also page 1536 of the same officer's Annual Report for 1897.

There is little navigation that goes the full length of the route, but there are large navigation interests concerned with different sections of the route. Beginning at the northern end, there is an extensive summer navigation between Savannah and Thunderbolt and Warsaw Island, and in the winter season numerous small boats ply between oyster beds and canning factories. Between Savannah and Darien sailboats ply irregularly, carrying rice and other produce. Between Darien and Sapelo Sound there is an enormous timber trade, which is much hampered by the incomplete state of the dredging in Mud River. Between Darien and St. Simons Mills, and other mills near Brunswick, is also a very extensive timber trade.

Between Brunswick and St. Simons and Cumberland islands there is an extensive summer navigation. There is a small daily steamer between Brunswick and Darien, each way, and two between Brunswick and St. Simons Island. A large steamer makes a round trip daily between Brunswick and Fernandina, running in connection with the Mallory Line of steamers from Brunswick to New York. Several river boats use portions of the route in reaching Brunswick from the Altamaha, Satilla, and Little Satilla rivers, and in reaching Fernandina from the St. Marys River.

For the year 1900 the commerce over this route amounted to about 42,000 tons of freight, valued at about \$2,500,000, besides 190,000,000 feet B. M. of timber, valued at \$2,000,000. There were carried by boats over the route 65,000 passengers, principally between Brunswick

and Cumberland and St. Simons Islands, Georgia, Fernandina, Fla., and Darien, Ga.

None of this commerce went over the entire route.

MISCELLANEOUS.

The work is located in the collection districts of Savannah, Brunswick, St. Marys, Ga., and Fernandina, Fla. The amount of duties collected in 1900 was: Savannah, \$69,453.90; Brunswick, \$15,869.87; St. Marys (nothing), and Fernandina, \$6.49, respectively. The nearest light-houses are those upon the Savannah River, near the beginning, and Amelia light at the end of the route, with Sapelo, Wolf Island ranges, St. Simons, and Little Cumberland lights between. Forts Oglethorpe, Pulaski, and Screven, Ga., and Clinch, Fla., are the nearest forts.

The emergency river and harbor act of June 6, 1900, provided for a preliminary examination and survey of the Skiddaway Narrows, connecting the Isle of Hope River with Burnside River, for a channel 75 feet wide and 6 feet deep at mean low water.

The report on the above is printed as House Ex. Doc. No. 91, Fifty-sixth Congress, second session.

Should the improvement of this inside route waterway, as recommended in House Ex. Doc. No. 41, Fifty-second Congress, first session (printed on pp. 1309 to 1326, Annual Report of the Chief of Engineers for 1892), be carried out, the sum of \$40,000 can be economically and advantageously expended during the coming fiscal year. It is proposed to expend any sums that may become available in improving the channel at Mud River, Habersham's Creek, Jekyl Creek, and the "Dividings."

Money statement.

July 1, 1900, balance unexpended.....	\$132. 59
July 1, 1901, balance unexpended.....	132. 59
{ Amount (estimated) required for completion of existing project.....	56,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	40,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Previous to the existing project there were appropriated as follows:

Parsons cut or Romerly marshes, Georgia:

Act of Congress approved—	
August 2, 1882.....	\$10,000. 00
July 5, 1884.....	10,000. 00
August 5, 1886.....	17,475. 00
August 11, 1888.....	4,633. 77
Total by United States.....	42,108. 77
From Georgia and Florida Steamboat Company.....	5,000. 00
	47,108. 77

Jekyl Creek, Georgia:

Act of Congress approved—	
August 11, 1888.....	5,000. 00
September 19, 1890.....	7,500. 00
July 13, 1892.....	7,500. 00
August 18, 1894.....	4,000. 00
	24,000. 00

Since the existing project for improving this route was adopted, three appropriations, aggregating \$49,000, have been made as follows:

Inside route:	
Act of Congress approved—	
July 13, 1892.....	\$15,000. 00
August 18, 1894.....	20,000. 00
June 3, 1896.....	14,000. 00
	49,000. 00
Making a total of.....	120,108. 77

N II.

IMPROVEMENT OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

The entrance to Cumberland Sound is situated between Cumberland Island, Georgia, and Amelia Island, Florida.

ORIGINAL CONDITION.

In its original condition the channel across this bar was generally only about 12 feet deep and very changeable as to location. It had a northerly location in 1843, swung gradually to the south till 1879, when it again broke out to the northeast and has since swung to the south till the present time.

PLAN OF IMPROVEMENT.

For information relative to the original plan of improvement of this locality see page 792, Annual Report of the Chief of Engineers for 1879. A revised plan, submitted in 1891, is printed on pages 1565 et seq., Annual Report of the Chief of Engineers for 1891. A second revision of the original plan of improvement, submitted June 12, 1895, and the report of a Board of Engineer officers, dated December 18, 1895, are printed on pages 1289 and 1293, respectively, Annual Report of the Chief of Engineers for 1896. This finally revised project was adopted by Congress by the river and harbor act of June 3, 1896.

The cost of the improvement was originally estimated at \$2,071,023; as revised in 1891 at \$2,079,500, and as revised in 1895 at \$2,350,000, for completion.

In general terms the plan of improvement provided for the construction of two jetties, inclosing the entrance, one springing from Cumberland Island and the other from Amelia Island, and extending across the bar. The various revisions of the project under which work has been done merely changed the details of the work.

By the act of Congress of June 3, 1896, the work was placed under the continuing-contract system.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1900.

Work was begun in 1881 and carried on at intervals till October, 1897. At that date the north jetty had been partially built for a total distance of 20,412 feet. It was from 2 to 6 feet below low water for the

first 17,000 feet. The balance of the distance it was a mere foundation, composed mostly of loose brush, with a very light load of porous limestone. It is now probably mostly destroyed by the teredo, and its location is covered with drifting sand.

The south jetty was partially built for a total distance of 13,500 feet. The first 1,200 feet was about 5.5 feet above mean low water; the next 2,500 feet was 4 feet below low water; then for 3,800 feet it was 12 to 16 feet below low water; the balance was an unsubstantial foundation similar to that in the outer portion of the north jetty.

For a summary of work done since July 1, 1899, see Annual Report of Chief of Engineers for 1900, page 1957.

CONDITION OF WORK JUNE 30, 1900.

On this date the condition of the work itself was probably unchanged from the previous year. The prevailing winds at this point being from the northeast, the enormous sand bank north of the entrance is constantly moving to the south and driving the channel before it. Since 1879 the channel has moved from a position between the locations of the jetties to a position crossing the axis of the south jetty, about 6,600 feet from the present low-water mark. This movement of the shoal and the channel has not been influenced to any extent by either of the jetties, except that the portion of the south jetty between the crossing and the shore stopped the further movement of the channel to the south. Those portions of the jetties likely to affect the shoal were mere foundations, over which the shoal advanced wholly independent of them. The inner portion of the south jetty fixed the location of the channel for a time, and it improved. Aided by a little dredging and the removal of a piece of the old foundation, this channel gave the port the best water it had ever had. The constant encroachment of the shoal on the north, with the other side of the channel fixed by the south jetty, apparently obstructed the free ebb flow so as to hasten the formation of a new channel to the northeast, which began to manifest itself in about 1897 and subsequently increased.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1901.

Jetty work was begun by Christie, Lowe & Heyworth, under their contract, on November 1, 1900. The work has been continued practically without interruption up to the close of the fiscal year. Most of the work has been done on the north jetty, which has been raised to high-water mark between stations 13260 and 16640. Considerable underwater work has been done on the south jetty, and a few days' work raising a short section of the north jetty to high-water mark near the inshore end. Longitudinal profiles of these jetties, showing the depths on the axes at the beginning of work under the present contract and at the present date, are shown on tracing¹ herewith. Fifty-three thousand one hundred and fifty-three and sixty-two hundredths tons of large rock and 69,569.43 tons of small rock have been placed during the fiscal year.

A supplemental contract, providing for heavier small rock and for both smaller and larger pieces of large rock, for raising the north jetty to high water for the 4,000 feet next the shore, and some other

¹ Not printed.

minor changes, was approved by the Secretary of War under date of June 21, 1901.

On September 25, 1900, a contract was made with C. P. Goodyear, at 16 cents per cubic yard, for dredging in the present channel. The time for completion of the contract was extended until July 1, 1901, by supplemental contract dated December 17, 1900. Under this contract 14,332.7 cubic yards had been dredged at the close of the fiscal year, and the navigable depth in the channel was 16.8 feet.

CONDITION OF THE WORK JUNE 30, 1901.

The old portions of the jetties have apparently not deteriorated during the year. The existing channel across the line of the south jetty has been maintained with a very small amount of dredging. The opening of the new channel between the jetties has been very much accelerated by the construction of the north jetty across the bar. In three months a large area on the bar (about 900,000 square feet) deepened about 4 feet. This is on the line where nature was opening a new channel. The acceleration accompanies the cutting off of the ebb flow across the line of the north jetty by the construction of the latter. This forces more of the flow to go seaward between that jetty and the shoal that crosses the line of the south jetty.

Jetty work is now going on very rapidly, the effective longitudinal jetty section constructed during the past year being 62,087 square feet. There had been 137,011 square feet constructed between 1880 and 1897, and it is estimated that 247,181 square feet remain to be constructed to complete the projected jetties.

COMMERCE AND NAVIGATION.

The ports dependent upon this entrance for sea commerce are Fernandina, Fla., and St. Marys, Ga. The latter place has only about 300 inhabitants and a very insignificant commerce of any kind. It has no railroad nor even a telegraph office. Fernandina has a population of about 4,500. It at present has only one railroad.

MISCELLANEOUS.

The work is located in two collection districts, the north jetty being in the district of St. Marys, Ga., and the south jetty in that of Fernandina, Fla. Amount of duties collected at St. Marys during 1900, nothing; at Fernandina, \$6.49. Amelia light is the nearest light-house and Fort Clinch, Fla., the nearest fort.

Money statement.

July 1, 1900, balance unexpended	\$853, 834. 17
Amount appropriated by sundry civil act approved March 3, 1901	200, 000. 00
	1, 053, 834. 17
June 30, 1901, amount expended during fiscal year	220, 596. 36
	833, 237. 81
July 1, 1901, balance unexpended	833, 237. 81
July 1, 1901, outstanding liabilities	60, 127. 08
	773, 110. 73
July 1, 1901, balance available	773, 110. 73
July 1, 1901, amount covered by uncompleted contracts.....	849, 055. 01
	895, 000. 00
{ Amount (estimated) required for completion of existing project.....	895, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901.....	400, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project for improving Cumberland Sound the following appropriations were made for the work:

By act of Congress of—

June 14, 1880	\$30, 000
March 3, 1881	100, 000
August 2, 1882	50, 000
July 5, 1884	75, 000
August 5, 1886	112, 500
August 11, 1888	112, 500

Total	480, 000
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Under the revised project of improvement the following appropriations were made:

By act of Congress of—

September 19, 1890	\$112, 500
July 13, 1892	170, 000
August 17, 1894	170, 000

Total	452, 500
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Under the existing project of improvement the following appropriations have been made:

By act of Congress of—

June 3, 1896	\$5, 000
June 4, 1897	350, 000
July 19, 1897	50, 000
July 1, 1898	450, 000
March 3, 1899	400, 000
March 3, 1901	200, 000

Total	1, 455, 000
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Contracts in force.

Name and address of contractor.	Character of work.	Date of approval.	Work begun.	Expires.
Christie, Lowe & Heyworth, Chicago, Ill.	Jetty	Aug. 30, 1900	Nov. 1, 1900	Within 4 years from commencement of work, subject to the provisions of paragraph 53 of the specifications.
C. P. Goodyear, Brunswick, Ga.	Dredging ...	Oct. 27, 1900	do	Within 90 days from date of commencement of work. <i>a</i>

a Extended to July 1, 1901, by supplemental contract.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Fernandina, Fla., from January 1, 1875, to December 31, 1900.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875	212	117,363	4,192	47	10,379	359	12	7,437	135	271	135,179	4,686
1876	210	141,354	4,749	25	4,893	179	28	9,232	249	263	155,479	5,177
1877	150	100,581	3,343	31	3,768	217	40	12,547	404	221	121,896	3,964
1878	183	120,845	3,900	17	3,985	101	22	8,294	215	222	133,124	4,216
1879	205	133,020	4,133	28	10,634	252	10	5,639	126	243	149,293	4,516
1880	270	146,722	4,470	34	22,396	598	22	9,463	240	326	180,581	5,308
1881	273	171,548	4,186	17	11,899	314	24	11,563	271	278	195,040	4,771
1882	239	146,383	3,279	16	9,056	242	15	6,639	151	270	162,078	3,672
1883	183	96,937	2,453	6	1,769	43	14	5,229	137	203	103,935	2,633
1884	176	105,061	2,864	3	865	21	10	4,029	88	189	109,755	2,973
1885	169	111,698	3,131	7	999	47	22	9,785	210	198	122,482	3,388
1886	205	147,418	4,014	7	2,112	53	15	5,187	146	227	154,717	4,213
1887	349	317,798	5,030	19	6,402	122	22	8,565	220	390	332,965	5,372
1888	274	179,130	4,456	19	7,152	156	18	6,789	177	311	193,071	4,789
1889	262	164,229	3,908	48	16,434	369	39	12,936	363	349	193,594	4,640
1890	267	172,202	3,948	40	14,683	305	33	11,518	306	340	198,403	4,559
1891	226	164,588	3,530	18	6,175	140	34	17,654	433	278	188,417	4,103
1892	247	189,855	3,760	26	10,027	195	54	39,487	805	327	239,361	4,760
1893	218	171,595	3,349	17	6,779	166	52	34,824	750	287	213,198	4,265
1894	149	148,543	3,077	21	8,030	162	44	51,401	899	214	708,014	4,138
1895	174	176,212	3,360	14	6,010	118	30	36,212	618	218	218,434	4,094
1896	169	124,046	2,051	17	7,015	127	30	37,052	659	216	168,113	2,837
1897	156	91,219	1,559	39	17,056	298	64	76,416	1,244	259	184,691	3,101
1898	157	110,993	1,643	21	9,784	153	68	64,163	1,127	246	184,940	2,923
1899	201	119,676	2,055	35	16,130	273	57	70,165	1,192	293	205,961	3,520
1900	213	257,257	2,031	46	25,295	375	67	68,993	1,093	326	351,545	3,499

CLEARED.

1875	229	121,028	4,303	31	8,239	228	15	5,343	212	275	134,610	4,743
1876	244	161,154	5,058	21	6,040	147	26	9,002	269	291	166,196	5,474
1877	165	106,615	3,590	24	6,340	166	42	13,741	412	231	126,596	4,168
1878	195	124,883	4,086	19	4,911	123	26	9,080	236	240	138,874	4,445
1879	175	129,654	4,079	31	11,067	258	12	8,016	164	218	148,737	4,501
1880	244	155,659	4,505	31	14,207	327	24	10,202	240	299	180,068	5,072
1881	204	138,593	3,730	41	22,007	506	31	15,335	351	276	175,940	4,587
1882	217	136,666	3,166	39	15,497	370	31	14,962	321	287	167,125	3,857
1883	153	85,815	2,245	32	8,925	210	24	9,413	231	209	94,153	2,681
1884	178	104,462	2,688	27	8,831	176	15	6,488	158	210	119,781	3,022
1885	185	112,936	2,570	33	10,251	249	21	9,393	221	239	132,580	3,440
1886	214	153,092	4,208	27	9,072	200	26	9,811	299	267	171,981	4,707
1887	306	326,342	4,500	29	8,552	232	33	11,607	327	368	346,501	5,054
1888	280	175,490	4,586	28	9,190	184	20	8,622	204	328	193,302	5,974
1889	298	181,075	4,240	46	13,652	342	45	16,286	428	389	211,013	5,010
1890	276	176,330	4,074	41	14,394	317	34	13,149	319	351	203,873	4,700
1891	228	156,272	3,507	18	6,407	186	49	31,117	702	295	193,796	4,345
1892	244	183,840	3,668	23	8,784	174	77	58,428	1,116	344	329,352	4,958
1893	191	137,724	2,761	17	6,605	137	75	63,347	1,224	288	207,676	4,122
1894	153	160,936	3,226	25	9,263	189	53	44,162	898	231	304,360	4,313
1895	186	200,301	3,682	12	4,519	96	23	18,997	349	221	223,817	4,127
1896	162	112,101	1,956	19	6,637	134	37	37,228	665	218	170,966	2,755
1897	168	87,742	1,532	21	8,121	168	82	104,534	1,714	271	200,397	3,414
1898	167	91,131	1,593	14	5,804	118	88	104,214	1,526	269	201,149	3,237
1899	195	108,854	1,846	21	7,265	164	99	128,479	1,856	315	244,598	3,866
1900	215	261,235	1,669	25	11,206	189	88	104,922	1,665	328	377,363	3,523

Arrivals and clearances of vessels and commerce at Fernandina, Fla., etc.—Continued.

COMMERCE.

Year.	Value of exports.		Value of imports.		Total commerce.	Duties collected.
	Foreign.	Coastwise.	Foreign.	Coastwise.		
1875	\$209,791	\$1,119,979	\$14,304	\$755,718	\$2,089,792	\$1,817.84
1876	226,076	1,170,240	46,17	1,131,032	2,573,827	2,181.40
1877	310,225	676,855	19,304	1,146,363	2,152,747	2,376.00
1878	248,000	780,607	8,142	172,234	1,901,983	2,090.00
1879	275,470	921,368	11,038	1,360,432	2,568,308	3,424.00
1880	257,780	667,092	3,676	1,365,857	2,294,405	7,808.00
1881	242,100	1,064,394	11,791	1,786,546	3,104,831	8,183.00
1882	292,400	1,342,421	45,792	7,536,588	3,217,201	36,590.00
1883	248,600	2,573,010	11,229	2,262,755	5,095,594	5,566.00
1884	173,690	1,164,462	1,874	1,738,620	3,078,556	1,331.00
1885	214,726	2,134,541	4,180	1,502,544	3,855,991	1,451.28
1886	191,595	2,843,000	590	1,625,000	4,660,185	808.00
1887	226,960	3,500,000	23,896	2,000,000	5,750,856	3,400.00
1888	175,150	2,500,000		650,000	3,325,150	4,655.06
1889	325,980	3,970,180	601	2,150,000	7,446,761	5,712.40
1890	478,475	2,245,753	10,902	4,997,683	7,732,813	7,335.32
1891	778,251	1,708,276		2,938,000	6,424,527	None.
1892	1,389,043	1,125,543	701	6,500,000	9,015,287	3,604.22
1893	1,412,920	1,804,330	214	7,000,786	9,218,250	96.30
1894	1,419,588	553,465		7,372,038	9,345,408	85.93
1895	1,467,305	570,295	3	2,366,627	4,408,230	3.00
1896	1,280,682	486,503	27,303	34,200	1,828,688	195.00
1897	1,932,407	989,204	1,417	2,006	2,925,035	418.86
1898	1,944,854	918,453	22,392	3,796	2,867,327	14.27
1899	2,596,717	5,990,608	38,775	114,314	8,740,414	98.96
1900	2,174,306	7,395,699	47,130	5,160	9,622,295	6.49

J. W. HOWELL, *Collector of Customs.*

N 12.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of an old lighter in Savannah River, Georgia; wreck of steamer *W. S. Cook* in Savannah Harbor, Georgia, and wreck of steamer *Pete Craig* in Savannah River, Georgia.

The wreck of an old lighter in Savannah River, Georgia, which was reported in my annual report for 1900 (see Annual Report of the Chief of Engineers for 1900, p. 1961), was removed. The cost of the work was \$79.16, and the unexpended balance of \$220.84 was returned to the Treasurer of the United States on November 9, 1900.

On February 6, 1901, the Chief of Engineers, by authority of the Secretary of War, allotted \$500 for the removal of the wreck of the river steamer *W. S. Cook* from Savannah Harbor, Georgia. The wreck was removed March 2-5, 1901. The cost of the work was \$140 and the unexpended balance of \$360 was returned to the Treasurer of the United States on March 14, 1901.

On May 10, 1901, the Chief of Engineers, by authority of the Secretary of War, allotted \$100 for the removal of the wreck of the river steamer *Pete Craig*, sunk in Savannah River, Georgia, near Twigg's bar. Owing to continued high water the wreck had not been removed at the close of the fiscal year.

N 13.

ENGINEERING METHODS.

The following methods have been in use in this district during the past year:

RIVER IMPROVEMENT.

The rivers in this district are somewhat peculiar, in that they are exceedingly crooked and usually quite narrow and deep, flowing

through extensive lowlands covered with a dense vegetation, principally of hard-wood timber, on a soil composed of a mixture of sand and clay, which, when filled with the roots of the profuse vegetation, erodes rather slowly, but when not thus protected and subjected to an unusual current, erodes quite rapidly. At the upper parts of the navigable streams, just below the cities of Augusta, Milledgeville, and Macon, the conditions of the rivers change somewhat, having greater slopes, more erosive banks, and being subject to deposits of detritus brought down by the rapids in the hilly country above. All of the rivers are very muddy at nearly all seasons, and there is no period when low water can be definitely expected, although the rivers are usually low during the months of September, October, November, and December.

The extensive lowlands, locally known as swamps, form great reservoirs for flood waters, so that the crest of the flood travels down stream very slowly, for example, the cresting eight days to go the 200 miles from Augusta to Savannah.

Navigation is greatly impeded by snags, which are usually formed by trees on the bank undermining and dropping where they grew. The largest are of moderate sizes. They are removed by snag boats of ordinary pattern, and deposited, wherever practicable, on the lower side of building points, where they are in a few years covered with mud and sand from the growth of the point downstream. Sand bars occur in the few miles near the head of navigation, and occasionally at points in the swamps. In past years endeavors have been made to remove these sand bars by spur dams, but the work was a total failure, the increase in depth being very slight and the spur dams near Augusta forming considerable of an obstacle for the free escape of flood waters, which frequently endanger the city of Augusta. Spur dikes have also been used in attempts to hold caving banks without any beneficial effect whatever. During the past three years training dikes, about 6 feet wide, built of small piling, filled in with brush bundles and a little rock, and held together with cross-ties, have been used for removing sand bars and also for shore protection. For the removal of bars the dikes have been built from 1 to 2 feet above low water, springing from one shore and running diagonally downstream to a point near the head of the shoal and reducing the width of the river by from one-third to one-half its previous low-water width, and then continuing downstream parallel to the opposite shore to a point below the bar. In every case, so far as known, the construction of the dike has been followed by the removal of the bar, although some of them have not yet been subjected to the test of extreme low water. The principle of their operation is to control the flow between a foot above low water and low water, which appears to cause the removal of the shoal without undue erosion to the opposite bank, or without undue interference with the flow of the river at flood stages.

As a shore protection, such dikes have only been tried at two or three places. In some cases they have proved very successful. In others, where the bottom was very soft, they will require extensive refilling. The principle of their operation is to hold the toe of the bank and the rest of it will take care of itself. Apparently they are less expensive than grading the bank and using mattresses would be, and as the current of the river is very swift at flood stages the mattress work would have to be heavily covered with rock.

Rock shoals are usually simply removed by blasting, as at most places where they exist the current at low water is quite sluggish and

there is no lowering of an upper pool by the removal of the shoal. In constructing the training dikes the last contractor devised a rather ingenious pile driver for the work, consisting of a flat with a double driver on one end, the axes of the two hammers being the proper distance (about 8 feet) apart. They are operated one at a time by a single engine. While one piling is being driven the winch heads on the engine are being used for hoisting another into position. The driver is held in place by two hinged and braced hooks of the proper length and arranged to catch the pair of piling last driven. This usually saves all anchors and mooring lines and enables very rapid work to be done.

ESTUARY IMPROVEMENT.

The estuary of the Savannah River has been improved by regulation and dredging. The regulation works consist of training walls constructed of piling, brush filling, waling pieces, cross-ties, with a light load of rock, in the upper portions of the harbor, and of thick mattresses of brush bundles, lightly loaded with a center ridge of rock, in the lower portions of the harbor, the width between the training walls increasing downstream in an endeavor to give the same theoretical tidal ebb velocity. The regulation works do not extend, on an average, as high as mean low-water mark. They have had no marked influence in creating a channel, but apparently have helped maintain it, causing sediment to be deposited in the water areas behind the walls rather than in the channel way. The existing channel has been mostly produced by dredging. Most of the dredging in the harbor has been done by small clam-shell dredges and dump scows, the material being placed wherever practicable behind the training walls. In handling the coarse sand in the upper part of the harbor, and marsh mud in creating channels adjunct to the harbor, suction dredges, pumping the material ashore, have been successfully used. Dredging of the latter class has been done at 9 cents per cubic yard. In the upper portion of the harbor, where logs and mixed material have been encountered, a vacuum dredge, consisting of an ordinary clam shell, dumping into a pocket, from which the material is forced by atmospheric pressure through a 12-inch pipe into a vertical cylinder 6 feet in diameter and about 19 feet high, called the pump, from which steam has been exhausted by spraying, and subsequently forcing it ashore through a pipe by steam pressure admitted to the cylinder, has worked very well. This kind of dredging, in a moderately small quantity, has been done for 12.4 cents per cubic yard.

BAR IMPROVEMENT.

This class of work has been done in this district by parallel jetties, the protecting one being built across the bar to near high-water mark and the other to low water, or above, and by dredging. All indications point to the fact that on the south Atlantic coast bars can be improved most economically by dredging alone, as the weather conditions are quite favorable to this kind of work with suitable dredges, and while the tidal rise is from 5 to 6 feet the sequence of tides is not nearly so favorable as on the north Pacific coast, where jetties are very successful and where dredging, owing to weather conditions, is very difficult. On the south Atlantic coast the large quantities of sand in pretty constant motion and the gentle slope of the bottom seaward require that parallel jetties be aided by dredging to a very great extent, leaving the results accomplished by jetties quite incommensu-

rate with their cost, except in some cases they secure the important object of greater permanence in the channel location than could be expected by dredging alone.

In building jetties there is good reason to believe that mattresses of any kind in the foundation are unnecessary and inadvisable, a layer of small rock making a better foundation. The jetties at Cumberland Sound are now being entirely composed of granite, the larger rocks being used in the superstructure. The rock is brought from Columbia, S. C., a distance of 266 miles, by rail. The larger rock are unloaded on a very large, heavy, and strong lighter, with a powerful derrick entirely operated by steam, the tracks being so arranged that an entire train of loaded cars can be conveniently passed under the derrick in succession as unloaded. Small rock are unloaded by hand direct from the cars to lighters moored alongside the trestle. At the works the small rock is unloaded by hand and the large rock by a steam derrick mounted on a derrick boat which remains in position on the work, except during the stormiest weather. Large rock is placed in the work at \$2.15 per ton and small rock at \$1.90 per ton.

N 14.

SURVEY OF BRUNSWICK OUTER BAR, GEORGIA.

PRELIMINARY REPORT.

[Printed in House Doc. No. 179, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 10, 1900.

SIR: The river and harbor act approved March 3, 1899, directs the Secretary of War to cause survey of the outer bar at Brunswick, Ga., to be made, and to report a plan, with estimate of cost thereof, with a view to obtaining a depth of 26 feet at mean high tide, with a width of 200 feet.

The duty of making the survey thus provided for was assigned to Capt. C. E. Gillette, Corps of Engineers, and I have now the honor to submit the accompanying copy of that officer's preliminary report, dated December 4, on the subject.

It will be seen that of the several methods of improvement mentioned by Captain Gillette he prefers that by dredging, at an estimated expense varying from \$40,820.40 to \$64,650—depending on the line adopted—if the work is done by contract.

Inasmuch as the channel once obtained will require dredging from time to time for maintenance, the local officer recommends an appropriation of \$150,000 for the construction of a dredge, and a further appropriation of \$25,860 for its operation. With the dredge and this appropriation he thinks the desired channel can be secured.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF CAPT. CASSIUS E. GILLETTE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., December 4, 1900.

GENERAL: In compliance with your letter of May 12, 1900, placing in my charge the survey and project of cost for improving Brunswick outer bar, Georgia, in compliance with the river and harbor act of March 3, 1899, I have the honor to state that since the date of the completion of the survey, August 25, 1900, my time has been unexpectedly occupied with duties foreign to the work of this office to such an extent that it has been impossible to prepare the report as early as desirable. The necessary investigations have been made, and the report itself, including the necessary maps, tables, etc., will be completed in about ten days. In the meantime I have the honor to submit the following general statement of the conclusions arrived at and recommendation as to method of improvement.

The available methods for improving this bar are:

1. Dynamite, which has been used in this particular locality.
2. Twin jetties.
3. A single jetty.
4. A single curved breakwater.
5. Dredging.

1. *Dynamite*.—From a careful investigation it may be briefly stated that a channel produced by the aid of dynamite is no more permanent than a channel produced by ordinary dredging, and such channel as has been made at Brunswick by this method has cost ten or twelve times what it would have cost to have dredged it.

2. *Twin jetties*.—On the South Atlantic coast jetties have mainly proved useful not so much in creating a channel as preserving its alignment to facilitate dredging and lessening the amount to be dredged. In this case the jetties would have to be very long, and their estimated cost to low-water mark is, for the north jetty, \$1,311,810, and for the south jetty \$1,517,798, making a total of \$2,829,608.

At this bar the channel changes very slowly, so that the jetties to preserve its alignment are not seriously needed, and the interest upon their cost, in addition to the cost of the necessary dredging, would be a very much greater sum than that required for dredging alone. Twin jetties are therefore not recommended.

3. *A single jetty*.—A single straight jetty on the north of the channel, the side from which the sands drift, would help nature to create a deeper channel than is now created, but unless built to high water would not control the location of the channel very much, and would not certainly do so even if built to high-water mark. The cost of the probable dredging necessary, together with the interest upon the cost of this jetty, would be much greater than the cost of dredging alone.

4. *A single curved breakwater*.—This is a theoretical plan which has been given an apparent but not real trial at Aransas Pass, Tex., where, while it has apparently proved a temporary success, at least so far as depth of water is concerned, yet the thalweg is so close to the breakwater as to be dangerous to shipping and also to endanger the structure itself by undermining, which apparently has already taken place to a serious extent. The practicable depth produced for ships at a reasonable distance from the breakwater has apparently not been produced in accordance with the theory of the breakwater, but more by the theory of twin jetties, there being opposite the breakwater a

jetty partly natural, consisting of the head of an island, and partly artificial, consisting of an ordinary stone and brush jetty, mostly submerged. Moreover, the drift of the sand is such that while the present arrangement may prove beneficial in producing a moderate increase in depth, that depth can not be increased to the requirements of navigation without a large amount of dredging, unless a second jetty is built and the breakwater completed by extending it in both directions so as to make a complete pair of parallel jetties.

5. *Dredging*.—Brunswick bar is especially favorably located for dredging. The channel changes very slowly, the sea bottom slopes away very gradually, and quite a portion of the bar is mud and not sand, so that the sand movement to fill the channel is unusually small, and it is recommended that the bar be improved by this method. The channel required by the act, of 26 feet at mean high water with a bottom width of 200 feet, can be produced by the dredging of 272,136 cubic yards, which, at 15 cents per cubic yard, amounts to \$40,820.40. This channel, however, will not be in the best location with reference to the light-house range or to future deepening and widening, which should be provided for. A straight channel on the better line will require the removal of 431,000 cubic yards, which, at 15 cents per cubic yard, will cost \$64,650.

This channel will, of course, require maintenance, and the most economical and sure method of providing for it is to provide a suitable Government dredge in the first place, with a moderate annual provision for operating it.

It is therefore recommended that an appropriation of \$150,000 be made for the construction of a dredge, together with \$25,860, which is the estimated cost of removing the above 431,000 cubic yards, at 6 cents per cubic yard, for which price it can readily be done after the dredge is provided.

Very respectfully,

CASSIUS E. GILLETTE,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

FINAL REPORT.

[Printed in House Doc. No. 355, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, January 17, 1901.

SIR: The river and harbor act approved March 3, 1899, contains the following provision concerning the outer bar at Brunswick, Ga.:

Improving the outer bar, Brunswick, Georgia: C. P. Goodyear, the contractor with the Government of the United States to deepen the outer bar of Brunswick, Georgia, under the river and harbor acts of eighteen hundred and ninety-four and eighteen hundred and ninety-six, shall be entitled to receive the sums appropriated by said acts for obtaining a channel twenty-four feet deep and two hundred feet wide, and a channel twenty-five feet deep and one hundred feet wide, provided the same are obtained on or before June third, nineteen hundred, and said acts are hereby amended accordingly. After the expiration of the time herein stated within which said work of improvement must be obtained, the Secretary of War shall cause a survey of the same to be made, and report a plan, with estimate of the cost thereof, with a view to obtaining a depth of twenty-six feet at mean high tide, with a width

of two hundred feet; and the sum of five thousand dollars, or so much thereof as may be necessary, is hereby appropriated to defray the cost of making said survey, and estimate based thereon.

The duty of making the survey provided for in the latter part of the item of law above quoted was assigned to Capt. Cassius E. Gillette, Corps of Engineers, and I have now the honor to submit the accompanying copy of that officer's final report, dated December 27, 1900, in which are given the results of a very thorough and careful study of ocean bars and the various methods employed in their treatment.

The improvement contemplated by the law for the outer bar at Brunswick consists in obtaining a depth of 26 feet at mean high tide, with a width of 200 feet. In concluding his report Captain Gillette states that, all things considered, dredging appears to be by all means the most economical and satisfactory method for work at this place. In his opinion, however, in addition to securing a channel as proposed, provision should also be made for its maintenance as well as for increased channel dimensions, when required by the interests of commerce. For the reasons given this can best be done by the construction and operation of a suitable dredge. The cost of such a dredge is estimated at \$150,000, and the operating expenses necessary to secure the improvement desired, \$25,860.

The division engineer, Col. Peter C. Hains, Corps of Engineers, concurs in the views of the district officer that dredging is the method of improvement best adapted to the locality in question, and that the dredging plant should be owned and operated by the General Government. He suggests, however, that provision be made by an appropriation of \$200,000 for the construction of the dredge and operating expenses for two years.

A preliminary report on this survey was transmitted to Congress by the Secretary of War December 10, 1900, and is printed in House Doc. No. 179, Fifty-sixth Congress, second session.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF CAPT. CASSIUS E. GILLETTE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., December 27, 1900.

GENERAL: I have the honor to submit the following report of a survey of the outer bar of Brunswick, Ga., with a plan and estimate of cost thereof, with a view to obtaining a depth of 26 feet at mean high tide, with a width of 200 feet, as provided for in the act of Congress approved March 3, 1899.

Work was begun on this survey immediately after June 3, 1900, as provided in the act. A tracing,¹ showing the results of the survey and borings along the present channel across the outer bar, is transmitted herewith.

The improvement of Brunswick Bar has never heretofore been under-

¹ Not reprinted; printed in House Doc. No. 355, Fifty-sixth Congress, second session.

taken by the Engineer Department of the Government. A moderate amount of work has been done under a contract made by Congress direct with Mr. C. P. Goodyear, of Brunswick, Ga., for deepening the bar by exploding dynamite, aided by dredging.

Prior to 1879 the channel depth across this bar was about 17 feet at mean low water. Between 1879 and 1889 this channel became obliterated and the best navigable depth at the latter date was about 13 feet at mean low water. The present navigable depth is 18 feet at mean low water.

The general principles covering the action of natural forces upon such bars may be stated as follows:

At the entrance to harbors and other inland waters, connected by narrow entrances to the sea, there is generally, and on sandy coasts almost invariably, a horseshoe-shaped sand bar around the entrance. The water inside and the water outside are invariably deeper than on the crest of the bar. Across this bar there is almost invariably one or more channels, the deepest of which is used for navigation purposes. Generally all except this one are insignificant. The sand of which such bars are composed is generally only from two to two and one-half times as heavy as water. It is often quite fine, and for that reason, and its general weight, it is put in motion at the slightest disturbance, and the shape of the bar is a plastic, flexible result of the forces of the waves and currents acting upon it.

These forces consist of the waves and currents generated by the winds and currents produced by the tide. Occasionally there is a general current up or down the coast produced by winds or by eddies from great ocean currents like the Gulf Stream. The tides and the winds, however, are the principal agents in molding the bar. The blowing of dry sand of the beach into the channels is an important element in causing changes. The principal channel mentioned, in most cases, is quite variable as to its location, but comparatively constant as to its depth. The reasons for the changes in position are quite simple. The waves and currents resulting from the prevailing winds drive more sand into one side of the channel than into the other. The ebb current, which is always stronger than the flood current, scours the sand from both sides of the channel. The result is that, while the channel maintains its depth, it is gradually driven before the prevailing winds until, after a time, such change in direction makes the channel very long, and the resulting friction obstructs the free flow of the tide, and a new channel will break out in a direction squarely against the prevailing winds. This is the almost invariable history of all such bars.

On the South Atlantic coast the prevailing winds and a predominance of the storms come from the northeast. The channels, therefore, swing around to the south, and then break out to the northeast again. On some parts of the Pacific coast the process is just the reverse. The prevailing winds come from the southwest, the channels travel to the north, and then break out to the southwest again. The period occupied in making the complete swing is quite variable for harbors comparatively near each other. The reason for this is that the forces causing the change may act with each other or against each other. If the tidal wave strikes the shore line obliquely and in such a direction as to aid the prevailing winds, the change will be comparatively rapid. If it strikes it obliquely in the other direction, they will tend to neutralize each other, and the change will be slow. Brunswick Bar is an exceedingly slow one to change. The reason of

this is that it is not in a region of long-continued storms or high winds. The prevailing winds and storms are from the northeast. The tidal wave strikes the coast so that it neither helps nor obstructs the wind currents.

The shape of the entrance, however, is such as to retard the action of the winds. The entrance is north of the main body of water inland. The ebb tide, therefore, has a tendency to wear away the north side of the channel faster than the south side, which nullifies, to some extent, the action of the winds, and the movement of the channel is exceedingly slow. A further cause of this slowness is the fact that the bar is located near the apex of a deep indentation on the coast, extending from Cape Hatteras to the southern portion of Florida, and the slope of the bottom seaward of the bar is very gradual, so that the heavy seas are broken up before they reach the bar.

METHODS OF IMPROVEMENT.

There are five methods of deepening the channel on such bars which have been used by governments or private individuals with greater or less success at different places. It will be proper to consider them in turn:

First. Dynamite, which has been used in this particular locality.

Second. A single jetty.

Third. A single curved breakwater.

Fourth. Twin jetties.

Fifth. Dredging.

(1) DYNAMITE.

The idea of opening a channel through an ocean bar by dynamite was originated by Mr. C. P. Goodyear and associates, of Brunswick, Ga., in about 1891. So far as the writer knows it has never been tried at any other points except at Brunswick and at Aransas Pass, Tex. It has not generally been accepted as a feasible method, and the discussion of its merits must rest largely upon the claims of those who believe in it or have tried it. Such statement has been given in a brief of Mr. C. P. Goodyear, presented to Congress in 1899, and given as Appendix No. 1 to this report. A letter from Mr. E. L. Corthell, an eminent American civil engineer, on the subject, to the chairman of the Senate Committee on Commerce, is given as Appendix No. 2, and a communication from J. A. Bryan, a practical dredge man, in support of Mr. Goodyear's theory, is given as Appendix No. 3.

These cover practically all of the documents available that give a discussion of the engineering features of the dynamite method, except a series of extracts from Wheeler's "Tidal Rivers," printed by Mr. Goodyear in connection with the above letters of Mr. Corthell and Mr. Bryan, but these quotations distinctly refer to river and estuary channels and have no apparent connection whatever with the improvement of ocean bars, and so are not reproduced here. Some extracts are also given from Stevenson's "The Construction of Harbors," and Harcourt's "Harbors and Docks," but if any of them have any bearing on dynamite as a method of bar improvement the writer has not been able to discover it, so they, too, are omitted from the discussion.

So far as the writer knows, with the exception of Mr. Corthell, no engineer experienced in bar improvement has sanctioned the dynamite method except Mr. Lewis M. Haupt and Mr. H. C. Ripley, who appeared before the River and Harbor Committee of the House on

April 7, 1900, as advocates of Mr. Goodyear's method. It is to be noted, however, that these two gentlemen were the consulting engineers who designed the curved breakwater at Aransas Pass, Texas, built in 1895-96, which produced no results till after Mr. Goodyear had exploded 35,000 pounds of dynamite on that bar. Numerous writings from the pens of these gentlemen have since appeared on the success of the Haupt reaction breakwater at Aransas Pass, but in none of them is Goodyear's work given credit for doing anything beyond breaching an old intercepting jetty. It is difficult to comprehend upon what theory these engineers can claim that dynamite could produce distant effects at Brunswick, enabling nature to produce a fine channel, and at Aransas Pass simply produce a local effect, leaving the curved breakwater the full credit of deepening the bar. This breakwater is discussed further on in this report.

HISTORY OF BRUNSWICK BAR.

Some of the allusions to this bar in the above documents are slightly misleading. It is exposed to "the full force of wave action, which is very heavy on this part of the coast;" "a stormy sea-bar," etc. (Appendix No. 2, p. 50.) All sea-bars are more or less stormy and exposed to wave action, but an ocean bar more favorable than Brunswick for dredging operations or other similar work could hardly be found in the United States. Storms are few and far between, being mostly short and sharp tropical hurricanes which do not produce any prolonged heavy seas. Work of the kind that could be carried on at Brunswick for forty or forty-five weeks in the year could not be carried on at Humboldt Bay, California, for example, for more than two or three weeks in the year. The causes above enumerated for the slow change in the bar, and that slowness itself, all make this bar a very favorable one to work upon.

Prior to 1879 a wide and deep channel entrance through the outer bar at Brunswick existed of nearly 23 feet, at mean high tide, nearly 900 feet wide. (Appendix No. 1, p. 40.)

There was a deep, wide, navigable channel. (Appendix No. 2, p. 50.)

Shoaling began in 1879 and is assumed to have been caused by the wrecks of two ships in different channels. It was, however, merely coincident with those wrecks and not at all a result of them. This will be discussed further on.

In 1891 efforts were made to open a channel by exploding dynamite, aided afterwards by harrows, other similar appliances, and finally, by ordinary hydraulic dredging. A good channel now exists, and the question is as to how much of that channel has been caused by dynamite, how much by nature, and how much by ordinary dredging, with a view to finally determining the value of dynamite for this purpose, considering the cost of the work to the Government and to the contractor.

The literature of the matter is rather discordant, taking the statements of the friends and enemies of the method from the documents and oral presentations, in addition to the above, that have been presented to Congress, as the following quotations will show:

AMOUNT REMOVED FROM THE BAR BY CONTRACTOR GOODYEAR.

"About 900,000 cubic yards" (H. C. Ripley). "Can not fall far short of 2,000,000 yards" (J. A. Bryan). "Approximately 75,000

cubic yards by ordinary dredging, which was probably not more than 5 per cent of the whole amount removed" (E. L. Corthell, February 7, 1899, Appendix No. 2, p. 52). This would make about 1,500,000 cubic yards removed altogether.

Under date of May 31, 1899, Mr. H. L. Marindin reports that, taking a belt 400 feet wide, 83,694 cubic yards had been removed since Goodyear began operations, but if a strip 600 feet wide was considered, only 72,676 yards had been removed, and states: "The results given in the foregoing table indicate that the wider the belt examined the less is the volume removed." Mr. Corthell stated, three months before this, that 1,500,000 yards had been removed, but this statement appears to have been based on incomplete evidence.

The amounts removed, as indicated by the official surveys, will be given further on.

NATURE OF THE MATERIAL COMPOSING THE BAR.

On this subject the testimony is also somewhat variable.

At the beginning of work the bottom of the channel for from nine-tenths of a foot to a foot and more in depth on top was composed of sand and shell and gravel. Immediately underneath this top layer of sand and shell and gravel there was a layer of blue clay averaging about 4 feet in thickness. (Chas. E. Arnold, pilot and superintendent.)

The material of the surface of the bar consists of about 70 per cent of medium gray sand and about 30 per cent of broken shell, with traces of fine gravel, or rather of a coarser sand. This material is only 3 or 4 feet in thickness, and beneath it is found a dark-blue sticky mud, the depth of which is unknown, but is probably very great. (Lieutenant Rees, quoted by Mr. Goodyear in his brief.)

Mr. Goodyear does not give the full quotation. Lieutenant Rees goes on to say, "while under water it is soft and very easily eroded."

A Mr. Dillon, of Brunswick, quoted by Mr. Goodyear, states that the blue clay of the marshes does not erode and is the same as the mud under the bar. Professor Haupt and Mr. H. C. Ripley state that the surface of the bar is a sort of hard crust that rings when struck with a sounding pole.

Lieut. Thomas H. Rees, Corps of Engineers, United States Army, in his report¹ of December 10, 1891, above quoted, states:

By wading along the beach or on the shoals during low water it was found that while the ebb currents continued the bottom was firm and compact and it was impossible to force even the flat blade of an oar into the sand more than an inch or two. As soon, however, as flood currents were established the bottom became soft and loosened, the feet would sink into the sand, which seemed to be washed away from around them, and the slightest motion would throw the sand into suspension. An oar could now be forced some distance into the bottom. While some experiments with dynamite, with a view to deepening the bar, were being carried on by the city of Brunswick during the months of July and August last, the diver who was employed in sinking the charges was questioned in regard to the character of the bottom during ebb and flood tides, and he stated that during the ebb the bottom was hard and smooth, but on a flood tide the sand was "alive" and the bottom soft and shifting. And further, that during ebb tide the water was generally clear, unless "roiled" by stormy weather, so that he was able to see quite distinctly; while during flood tide the water was always so turbid that he was in total darkness at the bottom and could see nothing. He also stated that he had found these same conditions to exist at all the sandy harbors of the Atlantic coast where he had been employed in diving. The consensus of opinion among the pilots of Brunswick Harbor was that the bottom was "alive" during flood tide and hard and firm during the ebb, and my own observations during the progress of this survey lead me to the same conclusion.

The existence of this difference in the condition of the sea bottom near shore during ebb and flood tides being established, it is natural to seek some explanation for so singular and important a phenomenon, and a possible one is found in the differ-

¹ Printed in Annual Report of the Chief of Engineers for 1892, page 1331 et seq.

ence of hydraulic levels that is maintained by the tidal wave as it approaches the shore. During flood tide the greater elevation of surface exists out at sea and the water flows in toward the region of lesser height near shore, not only over the bottom, but it seeks also to find a way through the saturated sands and mud of the bottom, and on emerging from them it lifts and stirs the sand, producing the condition known as "live sand." As the reverse slope of the tidal wave approaches the shore the lesser elevation of surface exists out at sea and ebb currents are established, the seaward flow taking place not only over the sands but seeking also to penetrate them, and this tendency of the water to flow into the sand near the shore compacts and hardens it, thus producing the condition described as existing during ebb tide.

Whether this is the correct explanation or not it can not be doubted that the condition of "live sand" attendant on the flooding of the tide must exercise a marked influence on the resultant direction of sand transportation by the tidal currents.

Mr. E. L. Corthell says:

Granting that the material in the course selected could have been dredged, it was evidently too tough and nonerosive for the cut to have been enlarged by current action. (Appendix No. 2, p. 51.)

The bar * * * was composed on its surface of a series of shell reefs with underlying strata of pure blue clay. (Appendix No. 1, p. 40.)

Shoals, extending from the north breakers to the south breakers, shoals which were nonerosive by the currents, composed on the surface of shell, sand, and gravel cemented together, with an underlying stratum of blue clay equally nonerosive. This material was very difficult of removal by any process. (Goodyear's brief, Appendix No. 1, p. 46.)

It should be said here that this last description is of a bar totally different from any that the writer has ever heard of on a sandy coast, and it is very difficult to reconcile it with the previous existence of "a channel nearly 23 feet deep at mean high tide and nearly 900 feet wide." (Appendix No. 1, p. 40.)

THE EFFECT OF DYNAMITE AT A DISTANCE UPON THE BAR.

But there is another effect—a vibration through the earth—which can be distinctly felt at St. Simons Island, $4\frac{1}{2}$ miles away, whenever a 100 or 200 pound charge is exploded on the outer bar. Vessels have felt this shock at long distances from the bar and not within sight of it, and masters and sailors, without knowledge of the explosion of dynamite, thought it was an earthquake shock.

In the blue clay, through which I worked $6\frac{1}{2}$ feet, it had the local effect of tearing it up, dissolving much of it; * * * but it is not this local feature of the use of dynamite which gives it great importance as a bar deepener, either as a principal agent or as an auxiliary. It is the vibrations through the bar over wide areas which change the condition of the material from nonerosive to erosive material, enabling the currents to take it up, put it in suspension, and carry it away. The effect of 100 and 200 pound explosions for thousands of feet away from the immediate scene of the explosion has changed the character of material, loosened it, and rendered it erosive.

In the hard-packed sand of the Gulf * * * [at Aransas Pass] we could not force a $\frac{3}{4}$ -inch iron rod into the bottom when not shooting dynamite. When shooting it we could work an ordinary oar or pole in it from 2 to 3 feet.

On the Brunswick Bar, during the progress of the work, large spar buoys were loaned me by the Light-House Board * * *. As the channel was widened by the work it at times became necessary to move these buoys, which were held in place by mushroom anchors, weighing 2,000 pounds each. When moved at times in which dynamite was not being exploded, it was very difficult to break out the anchors, which had become embedded in the material of the bottom, with a powerful tug, and in three instances a large hawser was broken in the effort. When dynamite was being exploded the material on the bottom was loose, and the buoys were moved by the tugs with the greatest ease. Cross-section lines of soundings, taken across the bar from the north breakers toward the south breakers, as well as cross-section lines across the deep-water pockets seaward and inward from the bar, showed widening and deepening. This widening and deepening is over areas of half a mile in width, and are all due to the peculiar vibratory action of dynamite and to the greater volume and velocity of the currents and their great erosive power in channel lines

caused thereby, the current being able to seek the sea that way instead of by wide dispersion over shoals north and south of this half-mile width. (Goodyear's brief, Appendix No. 1, pp. 48 and 47.)

The explosions of dynamite in large quantities shook up, disintegrated, and changed the character of the material over large areas, making it erosive. (E. L. Cortbell, Appendix No. 2, p. 51.)

Dynamite breaks up the crust of the bar, but is less effective in clay than in other materials. (Prof. Lewis M. Haupt.)

The effect is not confined to the immediate scene of explosion, but is far-reaching. Fish jump out of water 1,000 feet away. Wrenches would jump from racks on a boat 2,000 feet away. (Capt. Ben Fahm.)

At Aransas Pass, Texas, while dynamite was not being exploded, it was impossible, even with the aid of two men, to shove an iron rod or oar into the sand to any appreciable distance, but after the use of dynamite an ordinary pole could, for 1,000 feet from the scene of the explosion, without difficulty, be shoved into the sand from 2 to 3 feet, which condition existed for about twenty-four hours after the explosion, the water then packing the sand hard again. (Pilot Arnold.)

These statements are quite remarkable and are apparently rather strong evidence that dynamite can produce considerable effect at a considerable distance. However, the effect on fish and on marine boilers could be produced by a shock that would by no means disintegrate "cemented shoals" or "packed sand." That fish jump out of water at long distances from the explosion is perhaps best illustrated by the small boy's experiment of clicking two stones together under water, while a companion, with his ear under water at a considerable distance, listens and receives something of a shock. This effect is nothing but sound transmitted through water. To affect the fish and the boiler there is probably an instantaneous, jerky pressure that is startling to the one and injurious to the other, but neither would indicate the slightest effect at disintegrating the bottom. An instantaneous water pressure applied all over the bottom at once could not be expected to disintegrate it or to loosen packed sand; it would be much more liable to pack the sand harder if anything.

The shock through the ground, if of enough importance to disintegrate the bar "thousands of feet away," would naturally show a gradually increasing effect at points nearer the explosion, but in cases where such effects are visible, as an ordinary explosion not under water, we know that the visible effect is confined to the immediate vicinity, ceasing suddenly, instead of gradually lessening at greater distances.

That the shock of explosion should loosen packed sand 1,000 feet away is very remarkable, but the testimony on this point, while apparently conclusive, is really somewhat vague. The observers may not have been cognizant of the peculiar condition of sand on ocean bars of being "alive" at flood tide and hard at ebb, as described by the diver referred to by Lieutenant Rees and quoted above. This probability is rendered greater by the statement of Pilot Arnold that the effect lasted twenty-four hours. The facts concerning the condition of the sand at ebb and flood tide would indicate that, under normal conditions, on the Atlantic coast, the sand, without any dynamiting, is "alive" for six hours, and then hard for six hours, and so on. On the Gulf coast the periods are twelve hours, though the tide there frequently runs one way for a day or two under the effect of steady winds and large areas of inland water.

Mr. D. M. Picton, of Rockport, Tex., gave the writer a somewhat different version of the facts stated by Pilot Arnold. He said that for a short time immediately after an explosion at Aransas Pass a pole could be easily pressed down 2 or 3 feet into the sand in the immediate

vicinity of the explosion, and if left there a short time the sand would settle down about it so that it would be very hard to pull up.

To create channels at long distances from the scene of explosion, as claimed by Mr. Goodyear, dynamite must be capable in each case of producing three distinct effects, as the quotations heretofore given indicate that the three classes of materials must have been in each case encountered:

First. It must disintegrate tough, nonerosive blue clay, as that material is stated to have existed all over the bar quite close to the surface.

Second. It must break up and disintegrate "nonerosive" shoals, composed on the surface of shell, sand, and gravel, cemented together, and extending from the north breakers to the south breakers.

Third. It must, at least in some cases, loosen packed sand.

The first of these seems wholly impossible on its face. Surely a tough stratum of clay can not be torn up at any reasonable distance from the explosion.

The second certainly appears very dubious from the reasoning just given.

The third might be possible, but such sand appears to be loosened and repacked at every tide. The process of such packing can be observed on any beach. If the sand within reach of the waves is loosened up a very few waves will serve to smooth it all down hard and tight. Can that be anything more than the settling down and fitting to each other closely of the separate particles of sand? And would a distant shock of dynamite do anything more than help settle it closer and harder?

To throw some light on these points the writer made a small experiment on Tybee beach. Ordinary eggs were buried in the sand from 1 to 3 inches deep and just awash at low tide. At high tide a charge of 42 pounds of 60 per cent dynamite, *Ætna* brand, was exploded. It threw a column of water and sand about 80 feet high, and fish jumped from the water 600 feet away. The nearest egg—about 110 feet away—was, at the next low water, found broken; two, at about 115 feet, were intact. Of those at 160, 165, 210, 215, 310, 315, and greater distances, none were broken. A few had been washed out and floated away, owing to not being buried deeply enough. The broken one still retained its contents. The sand was found very tightly packed about the eggs. This experiment indicates that 100-pound charges of dynamite have a very mild effect on the bar at quite short distances. Doubling the charge by no means doubles the distance at which an effect is produced.

It is claimed, though, that the dynamite must have produced powerful effects at a distance, because at Brunswick the channels have been produced, and dynamite must have been the agent.

This contention rather begs the whole question. The additional deepening may have been the result of natural causes, aided by dredging. To investigate these things and to throw light upon the whole subject an examination of the various surveys of the bar that have been made during the period of work, from 1891 to 1899, is necessary.

Unfortunately these maps¹ are drawn to various scales; some refer to high water and some to low water. To enable them to be intelligently compared they have been reduced to the scale of about 400 feet to the inch, except one or two already at that scale, or nearly so.

¹The maps and figures accompanying this report are not reprinted; printed in House Doc. No. 355, Fifty-sixth Congress, second session.

The soundings on the bar have all been reduced to the same plane—mean low water—and new contours, showing 12, 15, and 18 feet depths below that plane, drawn in. All others are omitted to avoid confusion. These tracings are herewith marked A to O, inclusive.

Those marked A, B, C, E, F, and G are from surveys by the Engineer Department, United States Army; D, H, and L, by officers of the Navy; I, J, and K, by a Board consisting of the chief of the Coast Survey and two engineer officers; and M, N, and O, by an officer of the Coast and Geodetic Survey. They include all official surveys during the period mentioned.

The line of best water for navigation purposes across the bar is shown on each map, the axis of the present channel being indicated for comparison. On or near each line of best water is shown a controlling depth, which is marked with a cross and the depth given.

Mr. Goodyear claims that the surveys have been made mostly by persons prejudiced against his methods or interested in preventing his continuance at work, this contention being specially important as concerns the original survey, showing conditions when he began work—he claiming that while the original survey was made before dynamite had been suggested, the report was not written or the maps made till after his first season's work was ended.

For this reason the original survey by Lieutenant Rees, in 1891, has been very carefully examined into. The field work having been done before any dynamiting had been done, or apparently thought of, the original notes in the survey books must be without prejudice. The writer has personally examined these notes and finds them free from erasure, interlineation, or alteration. Enough of the reductions of the soundings have been also personally checked to see that this was properly and accurately done. The whole work has been found correct. It was found, however, that the final map was made up from two independent sets of soundings, made four months apart, viz, January and April, 1891. In this period, liable to rough water, some changes in the bar might be expected, so the two sets of soundings have been separately platted and appear on maps A and B. A small area right on the crest of the bar was not covered by the last set of soundings, but its omission is of minor importance.

These two maps are interesting, as they show lively changes going on in the bar before there had been any dynamiting to disintegrate the material and “render it erosive.” Notice how the long tongue of deep water, 18 feet, is making seaward from the deep pocket inside. This is quite near the location of the present Goodyear channel and shows a decided tendency to deepen on that line. This was months before “it developed that natural laws were greatly aiding the work” (Corthell, Appendix No. 2, p. 51); months before “soundings showed us that at a point of less depth by 3 feet than where we were working, nature, *aided by these vibrations*, had broken through.” (Goodyear's brief, Appendix No. 1, p. 48.) Nature had nearly broken through, apparently, without the vibrations.

From these maps and information from Mr. Goodyear, furnished to the House Committee on Rivers and Harbors, the following table has been prepared. It shows the dates of the surveys and of the dynamite or other work upon the bar, the controlling depth in the best navigable channel, the location of this controlling depth with reference to the present channel, and the general distance of the channel from the preceding dynamite work.

Table showing dates of surveys, methods of work, controlling depths, etc., at Brunswick outer bar, Georgia, between January, 1891, and November, 1899.

Dates.	Controlling depths at mean low water.	Location north or south of axis of Goodyear channel.	Authority.	Dynamite.			Distance of channel from preceding dynamite work.	Remarks.
				Amount used.	Charges.	Locality.		
January, 1891.....	13.3	800 N.....	Lieutenant Rees.....	Pounds.	Pounds.			Map A.
April, 1891.....	13.4	300 N.....	do.....					Map B.
July and August, 1891.....			Mr. Goodyear.....	6,500	10 and 20	0 to 500 feet south of present channel.		
September, 1891.....	13.4	150 S.....	Lieutenant Rees.....				0 to 500 feet.....	Map C.
June, 1892.....	13.0	400 N.....	Lieutenant Hughes.....	45,000	Mostly 100.	400 to 1,200 feet north of present channel.	1,500 feet.....	Map D.
August to December, 1892.....			Mr. Goodyear.....					
November, 1892.....	13.8	1,000 N.....	Lieutenant Rees.....				Coincides (probably). do.....	Map E.
January, 1893.....	13.9	950 N.....	do.....	35,000	Mostly 100.	In present channel.		Map F.
May to August, 1893.....			Mr. Goodyear.....					
November, 1893.....	14.1	600 N.....	E. A. Gieseler.....				50 to 500 feet.....	Map G.
February and March, 1894.....	13.9	500 N.....	Lieutenant Garrett.....				100 to 500 feet.....	Map H.
September, 1894 to March, 1895.....			Mr. Goodyear.....	(A)	100	In present channel.		
March and April, 1895.....	15.0	350 N.....	Captain Abbot.....	(B)	100	In present channel.	100 to 400 feet.....	Map I.
May to July, 1895.....	14.9	340 N.....	Mr. Goodyear.....	(C)	100	In present channel.	0 to 400 feet.....	Map J.
July, 1895.....			Captain Abbot.....					
August to December, 1895.....	15.0	300 N.....	Mr. Goodyear.....	(D)	100	In present channel.	0 to 350 feet.....	Map K.
December, 1895.....			Captain Abbot.....					
July to November, 1896.....			Mr. Goodyear.....			In present channel in present channel (?)		Dredging without bins.
August to November, 1896.....			do.....					Map L.
February, 1897.....	16.6	300 N.....	Lieutenant Peck.....	(E)	100	In present channel.	0 to 250 feet.....	Ordinary dredging beam.
August to November, 1897.....			Mr. Goodyear.....			In present channel in present channel (?)		gun.
Fail of 1897.....			J. A. Bryan.....				Probably coincides.	Map M.
September, 1897, to February, 1898.....	17.4	In present channel.	H. L. Marindin.....					
August to November, 1898.....			Mr. Goodyear.....	(F)	100	In present channel.	Coincides.....	Map N.
November, 1898, to April, 1899.....	17.1	In present channel.	H. L. Marindin.....	(G)	100	In present channel.	Coincides.....	Map O.
May to August, 1899.....			Mr. Goodyear.....					
November, 1899.....	18.5	In present channel.	H. L. Marindin.....					

NOTE.—A + B + C + D + E + F + G = 81,500 pounds; average, 11,643 pounds.

This table is an interesting one. From January, 1891, to December, 1895, the date of the last survey before a dredge was used, there was an increase in the controlling depth of best water of from 13.3 to 15 feet, or a total gain of 1.7 feet—not a very magnificent showing for four years of work. In addition, the location of the best water was by no means constant. The channel location continually changed so that the point of controlling depth went from 800 feet north of the axis of the present channel to 150 feet south of it and then 1,000 feet north of it, from which point it has steadily worked back to the present channel.

These extensive changes in the position of the channel make rather inapplicable some of the statements concerning the work, viz:

This method of work often left the channel irregular and lumpy and Mr. Goodyear obtained consent of Congress to use auxiliary means to smooth the bed of the channel and remove the lumps. (E. L. Corthell, Appendix No. 2, p. 51.)

The dynamite may have been mostly exploded on one general line, but the channel “produced” seems to have been quite independent of this line of dynamite work (previous to dredging) and hence should have been mostly away from the lumps.

I was commanded to use auxiliary means for smoothing the bottom of the bar. (Goodyear's brief, Appendix No. 1, p. 43.)

As the channel was widened by the work, it at times became necessary to move these buoys, etc. (Appendix No. 1, p. 48.)

The wanderings of these buoys on the maps are quite as extensive as the changes in location of the channel.

The table also shows an important fact, viz, that the two surveys made without reference to Goodyear's work (Maps D and H), by naval officers, each gives less water as the controlling depth than do either of the surveys immediately preceding or following them. This is quite confirmatory of the accuracy and fairness of the surveys made to determine the results of the dynamite work.

The facts of the table as to the location of dynamite work and as to dredging are from statements made by Mr. Goodyear, and are as complete as the statements. It appears that the dynamite was frequently exploded long distances from the location of best water shown by the next succeeding survey, distances apparently much too great for the explosions to have had any influence whatever in producing those channels.

The last survey before dredging was begun was in December, 1895. Dredging without bins began in July, 1896. The following February Lieutenant Peck's survey shows an increase of 1.6 feet of water, practically as much as had been obtained during the previous four years of dynamite work alone. Subsequent to Lieutenant Peck's survey ordinary dredging was begun, and since then an additional depth of 1.9 feet has been secured, making a total increase in navigable depth across the bar of 5.2 feet, of which 1.7 feet occurred during the four years of dynamite work alone and 3.5 feet during the four years that have elapsed since a dredge was first used.

These figures do not agree with some of the statements above quoted, viz:

This work has created a river in the open ocean 5 miles from land * * * 10 feet deeper than existed when I commenced work at the point where the channel crosses through the bar; 7 feet deeper than existed at any point across the bar when I commenced work. (Goodyear's brief, Appendix No. 1, p. 43.)

According to maps A, B, and O, the gain in depth on the line of the present channel, instead of 10 feet, can not exceed 7 feet, and is probably less than 6. Map A gives, at the shoalest place, 12.6 feet. At that point there is now a controlling depth of 19.3 feet, a gain of 6.7 feet. Map B gives 13.9 feet on the axis of the present channel. This would give a gain of only 5.4 feet, but the 13.9 sounding is not in the middle of the shoal, at which point there might have been a less depth, but the strong indications of scour at this point between the date of Map A, January, 1891, and Map B, April, 1891, give good reason to believe that the total gain in depth since 1891 has been less than 6 feet. At a subsequent period, viz, March, 1894 (Garrett's survey, Map H), there was a 12-foot shoal square across the present channel, and there was less than 13 feet at a point on the axis of the present channel as late as December, 1895, the last survey before a dredge was used. But even taking these as original conditions of the bar, they would only give a little over 7 feet as the gain in depth, which gain would necessarily all be since dredging was begun, and wholly incompatible with the following statement.

Of the 10-foot gain in depth at point where new channel crosses bar but 2 feet have been obtained while dredge was used and 8 feet were obtained before its use. (Goodyear's brief, Appendix No. 1, p. 43.)

The writer is wholly unable to reconcile these statements with the facts, except upon the theory of vagueness in the location of the original soundings and a neglect to observe the distinction between extreme high water and mean high water and extreme low water and mean low water.

The three maps concerned, A, B, and O, were all the results of careful instrumental surveys, the first two of which were made before dynamite work was begun or prejudice could have existed, and the third by Mr. Marindin, against whom no hint of prejudice has been made.

It may be noted here that all the surveys show among themselves a reasonable consistency and an air of probable accuracy that could not have been the result of anything but careful work and could not have been recognized till they were reduced to the same scale and notation. The steady travel of the point of controlling depth southward toward the location of the present channel is quite consistent; so are the indicated changes in shoals. The maps show the location of Mr. Goodyear's buoys in some cases and also the pits of explosions. These give strong indications that his work has been following the channel rather than the channel coming to a fixed location of the work.

The claim that ships drawing more water than the surveys indicated frequently crossed the bar was once the subject of many disputes, but is of minor importance at the present time, as the important points under consideration are most affected by surveys that are free from the suggestion of prejudice against Mr. Goodyear's theories. The discrepancies about depths may have been caused by inaccuracy in the draft of the ships or of the amount of rise of the tide. These matters were doubtless not observed with the systematic care taken in making the surveys.

AMOUNT REMOVED FROM THE BAR.

Let us now take up this subject, about which there appears to be so much discordant evidence.

The following table has been prepared from Rees's survey of April, 1891; Peck's of February, 1897, and Marindin's of February, 1898, and November, 1899:

Amounts removed from Goodyear channel and vicinity.

Period.	Width of of strip con- sidered.	Length of strip across bar.	Scour.	Fill.	Total removed.	Remarks.
	<i>Feet.</i>	<i>Feet.</i>	<i>Cub. yds.</i>	<i>Cub. yds.</i>	<i>Cubic yards.</i>	
April, 1891, to February, 1897	400	6,370	72,468	76,733	— 4,265	Fill.
	600	6,370	105,082	112,765	— 6,683	Fill.
	800	6,370	136,400	165,821	— 29,421	Fill.
	1,000	6,370	158,872	208,416	— 49,544	Fill.
April, 1891, to February, 1897	400	4,680	71,785	40,233	31,552	
	600	4,680	101,766	68,715	33,051	
	800	4,680	129,800	111,371	18,429	
	1,000	4,680	145,523	152,136	— 6,613	Fill.
February, 1897, to November, 1899....	1,500	4,680	150,500	294,000	—143,500	Fill.
	2,000	4,680	207,700	426,200	—218,500	Fill.
	400	4,680	121,600	3,430	118,170	
	600	4,680	160,840	15,880	144,960	
February, 1898, to February, 1899....	800	4,680	187,130	38,350	148,780	
	1,000	4,680	218,800	59,160	158,640	
	1,200	4,680	243,200	80,000	163,200	
	400	4,680	35,430	13,800	21,630	
February, 1898, to November, 1899....	600	4,680	49,000	27,350	21,650	
	800	4,680	68,750	39,400	29,350	
	1,000	4,680	82,100	51,400	30,700	
	1,200	4,680	99,900	57,620	42,280	
February, 1898, to November, 1899....	400	4,680	102,703	6,060	96,643	
	600	4,680	132,700	17,190	115,510	
	800	4,680	164,580	31,830	132,650	
	1,000	4,680	183,380	39,100	144,280	
April, 1891, to November, 1899	1,200	4,680	220,700	56,800	163,900	
	400	4,680	178,450	1,558	166,892	
	600	4,680	223,598	14,000	209,598	
	800	4,680	258,860	40,630	218,260	
April, 1891, to November, 1899	1,000	4,680	278,740	87,320	191,420	
	1,200	4,680	319,000	143,000	176,000	

a This area extends 570 feet farther, inshore and 1,120 feet farther seaward than the following areas, the later maps not permitting a longer comparison.

NOTE.—The total amount from 1891 to 1899 can not be exactly obtained by adding the amounts for 1891 to 1897 and 1897 to 1899. This is due to the smaller scales of the later maps, making closer comparisons possible by taking a different set of sections than was used in comparing 1891 with the later maps.

This table shows the remarkable fact that up to 1897 the total result of work in the vicinity of the Goodyear Channel was *a fill instead of a scour*. This was the period in which dynamite alone was used to do the work, aided only by harrows, rakes, and a dredge without bins, but not by ordinary hydraulic dredging.

While there was a scour or removal of material in some places there was a fill in others, the bulk of the latter predominating. Taking a strip of 6,370 feet long and 400 feet wide, 200 feet on each side of the Goodyear channel, the total result was a fill of about 4,000 yards. If, instead of a 400-foot strip, we consider one 600 feet, 800 feet, or 1,000 feet, the results are the same in kind but successively larger in amount—always a fill.

For the 1,000-foot strip the fill is about 50,000 cubic yards. This strip extends from a point inside where there was about 25 feet depth at mean low water before work was begun to a point outside of 26½ feet depth.

If a strip only 4,680 feet long, beginning in about 24 feet of water inside and ending in about 25½ feet outside (survey of 1891), be considered, the showing is not quite so bad, but the total scour is exceedingly small. It is only 31,500 yards for a 400-foot strip, increasing to

33,000 for a 600-foot strip, but diminishing rapidly for strips 800 to 2,000 feet wide, the latter showing quite an appreciable fill of over 200,000 cubic yards.

With these figures before us it is evident that Mr. Corthell must have had incomplete information when he made the statement (Appendix No. 2, pp. 50 and 51) that "the concurrent deepening and widening and general enlargement of the tidal channel as the dynamite work proceeded are results of the greatest importance;" or, "it was early noted during these successive periods of work that deepening of the entire bar was going on greater near the navigation channel, but quite considerably remote from it."

From 1897 to 1899, the period in which ordinary dredging was used, the scour was somewhat greater: 118,000 yards for a 400-foot strip, and increasing to 163,000 for a 1,200-foot strip. The latter figure is about two months' work of an ordinary seagoing dredge. But the fact that the quantity removed increased with the wider strips considered indicates that only a portion of it could have been removed by dredging.

To determine in what year the most of it was removed the tables showing the periods from February, 1898, to February, 1899, and February, 1898, to November, 1899, were prepared. The former period was the one in which the enormous tidal wave of October 2, 1898, occurred.

Taking the width of 800 feet for simplicity, the table indicates that there were removed from February, 1897, to February, 1898, only about 16,000 yards; from February, 1898, to February, 1899, the period of the tidal wave, about 29,000 yards, and from February, 1899, to November, 1899, about 100,000 yards. This indicates that the storm tide had little or nothing to do with the matter.

The fact that much the larger amount of the whole period was removed from February to November, 1899, the summer period of calm weather, which was free from any storm that year, together with a probable small use of dynamite, indicates more active dredging than usual during this period, and the small results from February, 1897, to February, 1898, are compatible with Mr. Bryan's statement that ordinary dredging was not begun till the "fall of 1897," and then only used with pockets a portion of the time.

The results for the total period from 1891 to 1898 are also quite meager—a maximum of 218,260 cubic yards, considering a width of 800 feet, 400 feet each side of the axis of the present channel.

For this there has been paid Mr. Goodyear \$220,000, and the numerous surveys to determine the results of his work have cost \$26,989.83, making a total of \$246,989.83, or at the rate of \$1.13 per cubic yard, assuming that the removal over this wide area was all useful, and that it was all done by Mr. Goodyear.

PERMANENCE OF DYNAMITE CHANNEL.

It must be admitted that the present form of the bar is no more permanent for having been produced by dynamite or "smoothing" machines, aided or unaided by nature, than if it had been produced in its present shape by dredging. The forces of nature must now act upon it as it is, totally without reference to its history.

It is argued, however, that the channel for dredging has to be arti-

ficially selected and may be in a place that nature would soon close up, while on the other hand the explosion of dynamite anywhere on the bar helps nature to "break through" where she desires to, and therefore in a place where the opening will be more nearly permanent.

It would seem that the fallacy of this reasoning as to the distant effect of dynamite has been sufficiently shown already, but it will not be improper to consider the subject further in connection with the assertions that have been made concerning this phase of the matter:

Had I undertaken to deepen this bar with a dredge there are other points of passage far shorter; I should have tried the short cut and it would have filled up. I tried the short cut twice in 1891 and in 1892, as above stated. Nature closed up the cuts I partially opened through the bar and continued to say to me "Here will I work with you and nowhere else." If I had used a dredge she could not have told me this, for the material would have remained nonerosive where she wanted her channel and her currents could not have eroded it and indicated her desire. (Goodyear's brief, Appendix No. 1, p. 48.)

Both the assertions and deductions of this quotation appear to be erroneous.

An examination of the maps will show that before dynamiting was begun any man of ordinary intelligence would have unerringly selected essentially the present route of the Goodyear channel for dredging operations. That route was then and always has remained the shortest route between the 18-foot curve inside and the same depth outside. It involved then, and has always since involved, less dredging to make 18 or 20 feet of water in a reasonably straight channel than any other route.

The "short cuts" tried by Mr. Goodyear in 1891 and 1892 were apparently longer routes than this. That the present location was the one that any engineer would have selected in 1891 is also established by the fact that it was on the south side of the long tongue of deep water extending seaward from the gorge between the islands. This is of the greatest importance in selecting the site for the channel, as the shoals to the northward were and are slowly moving southward, and the channel should have been located at the most southerly available point to which deep water extended. All considerations then made this the unavoidable location for the channel, overwhelmingly indicated before a pound of dynamite had been exploded on the bar.

The movement of the north shoal to the southward is a most important matter in this discussion and perhaps explains the entire situation. By comparing the maps herewith, marked Q and W, it will at once be seen what has become of the fine channel that once existed and why nature should recently have been making a new channel to the southward. It will be seen that the sailing lines of 1857 are now buried under an enormous sand bank, on top of which is only about 6 feet of water. The two cross sections, A B and C D, Map X, taken along lines shown on Maps Q and W, show this very plainly. Looking at these two sections one can see clearly that the free waterway to the ocean for the flow of the tides has become very much obstructed, and as the tidal volume crossing the bar in the same time as always has not been lessened, its velocity and scouring power must therefore be greatly increased, and it is to be expected that nature should make a new channel to permit the tide to flow as freely as before.

The movement of the north shoal to the south is undoubtedly the cause of the new channel opening. Its opening where it did is shown

by Map W to have been largely influenced by the further extension south of the north shoal seaward of the line of Section C D, Map X.

Thus the southward growth of this north shoal, while it has been the cause of the destruction of the old channel, has also been the cause of the creation of the new one. Mr. Corthell appears to claim this latter beneficial result for Mr. Goodyear.

Observations and examinations made during the progress of the work show that the material removed from the tidal channel has been deposited on the north and south breakers on each side of this channel, really forming underwater banks or submerged jetties, which have no doubt aided in the development and maintenance of this channel. (Appendix No. 2, p. 52.)

This theory seems to be disproved by two facts. The north shoal has certainly been moving south for the last forty years, or since the date (1857) of the first Government chart, and probably a great deal longer. About 1,500,000 cubic yards have been added to its southern face since 1891, at least 600,000 of which was previous to 1897, at which date less than nothing had been removed from the present channel and its vicinity. The growth of the shoal is by sands driven over its crest by the winds and waves from the northeast.

Also, since the north face of the south breakers (a 12-foot shoal), instead of being "converted by deposits into a sort of underwater jetty," has been scouring away correspondingly to the growth of the north shoal since 1857, and quite rapidly since 1888 (about 3,000,000 cubic yards, and 1,000 feet in width, scoured away between 1888 or 1890 and 1897 or 1900; see Maps T, U, and W), it would appear that the "observations and examinations made during the progress of the work" upon which Mr. Corthell based his statement must have been incomplete or erroneous.

The present depth of about 18.5 feet is somewhat greater than nature formerly provided, but that is fully accounted for by the 75,000 cubic yards of dredging Mr. Corthell states was done by Mr. Goodyear. The steady travel southward of the location of the point of controlling depth in the best water of successive surveys since November, 1892, is strong indication that nature and not dynamite was doing the work.

It is to be noted that the best water of December, 1891 (Map C), may possibly have followed the dynamite work. Also, that the sudden move of the channel 1,200 feet to the northward, shown on Map E, was subsequent to dynamite work there. The channel, however, was in that vicinity previous to the work (Map D). In all cases since that time the dynamite work appears to follow the channel, the steady travel south of which was in accord with nature, but not in accord with independent dynamite operations.

From these facts it seems proper to conclude that a location near the present channel would have been undoubtedly selected for dredging, and a channel dredged there would have about the same chance of permanence as the present channel. This latter is about 300 feet wide, and the side slopes on the south are about 1 foot in a hundred. The north slope is steeper—about 1 foot in 30. Taking the average at 1 foot in 50, and providing for a depth of $18\frac{1}{2}$ feet at mean low water, it is found that to dredge such a channel along the line of best water of the last survey, before Mr. Goodyear began work (Map B), would have required the removal of 103,287 cubic yards. Adding

about 21,000 yards to cover any extra depths that may exist in the present channel, and we have 125,000 cubic yards as the amount to have been removed to create a channel as good as the present one.

Fifteen cents per cubic yard is a fair price for this work. The contractor now working at Doboy Bar, the next bar north of Brunswick, and apparently of the same nature, gets 13.9 cents per yard, and he has had to build his dredge for this job. The price of 15 cents per yard may be objected to on the ground of "tough blue clay" and "sand, shells, and gravel cemented together." The report of the original survey of 1891 states "sand and blue mud," the latter when under water being "soft and very easily eroded." It is to be noted, too, that Mr. Bryan, the dredging contractor who did the dredging for Mr. Goodyear, while arguing that 15 cents is too small, gives the reasons of "distance from land" and the "weather conditions," but says not a word about tough materials (p. 54). The other two conditions are about the same at Doboy as at Brunswick.

At 15 cents the entire work would have cost \$18,750, a little over two-thirds the amount it has cost the Government for making the surveys to see what Mr. Goodyear had accomplished.

CONCLUSIONS.

From the foregoing the following conclusions seem reasonable:

First. Dynamite does not have any useful effect in bar deepening, except in loosening tough materials in the immediate vicinity of explosions. Such materials are very rare on bars along sandy coasts.

Second. The channel now existing at Brunswick Bar has been produced by nature, aided very materially by ordinary dredging. The useful effect of dynamite has been very small, except, possibly, to loosen materials in some places as an aid to the dredge.

Third. The cost to the Government of all material removed, whether usefully removed or otherwise, has been \$1.13 a yard, more than seven times the cost of ordinary dredging. The cost to the contractor is stated to have been even more than this.

Fourth. The channel produced has no advantage of permanence over a dredged channel of similar size and location, which could be produced for about one-twelfth of the cost of the present channel.

(2) A SINGLE JETTY.

The theory upon which ordinary single jetties, applicable to Brunswick Bar, have been proposed, is about as follows:

Due to prevailing winds and other forces a channel having a tendency to swing in one direction continues that process until its location is so nearly parallel with the coast and its length in shoal water so great that the increased friction causes it to break out anew in a shorter channel across the bar, usually in a direction against the wind; but if, when the channel in its swing has reached or is approaching a favorable location, an intercepting, single jetty be placed across the bar to prevent its passing this location, the natural forces will not be able to drive the channel to the unfavorable position above mentioned and there will be no necessity for its breaking out anew. The channel location thus being fixed, nature may be expected to deepen it, and is

assisted in this respect by the fact that the jetty cuts off a considerable escape of the tidal flow, which, added to the water normally flowing through the channel, would be expected to create greater depths. This principle requires the jetty to be located upon that side of the channel toward which the latter is being driven by the drifting sands. To use a phraseology analogous to that which has been used in other cases, it would be on the "leeward" of the channel.

So far as the writer knows, this principle of construction was first suggested by Maj. Thomas W. Symons, Corps of Engineers, United States Army.

A single jetty at Coos Bay, Oregon, has been built in accordance with this theory, and appears to have been successful in increasing the depth from 10 feet to not less than 18 feet, which latter it has maintained for the last five years.

A single jetty at the mouth of the Columbia River is, to a certain extent, based upon this principle, although Cape Disappointment seems to form a second jetty at flood stages in the river, when most of the bar deepening is probably done.

A single jetty on this principle at Brunswick would be located on the south of the channel, since the drifting sands come from the north. At this place, however, while the drift is comparatively slow, it is an enormous sand bank which moves and which always moves very positively in one direction, and it is difficult to see how such a constant force from the north could avoid crowding the channel close to the jetty and making it sufficiently deep near the latter to require extensive and expensive work to prevent undermining. The sailing line would also probably be too close to the jetty for safety, since the prevailing storms and high winds from the northeast would tend to drive shipping upon the jetty.

At Coos Bay, while the movement of the sand appears to be quite extensive, it is apparently not so positive in its direction as it is at Brunswick, and the movement is complicated by a projecting cape only two miles south of the entrance, so that probably the concentration of flow due to the single jetty has been able to resist most of the tendency of the south shoal to move north toward the jetty. No recent surveys to determine this are available.

Such single jetty at Brunswick could be built, as shown on the line "A-B" on the map of the recent survey herewith and on fig. 7. Its cost, making no allowance for protection against undermining, is estimated at \$1,517, 798. Interest on this at 3 per cent per annum is \$45,533.94, which, as will appear further on, is probably more than enough to create and maintain a sufficient dredged channel. This will be further discussed under the head of "Dredging."

A single jetty could be built north of the channel, on about the line "C-D," on the map of the recent survey herewith and on fig. 7. This would have a double effect, viz:

First. It would, if built high enough, stop the advance of the sand to the southward.

Second. It would concentrate the water which now flows over 180 degrees of the bar into a space of about 90 degrees.

It would naturally be expected that under these conditions the additional flow would create a deeper channel somewhere on the bar, but there would be no force to compel this channel to occupy a fixed

location, and no guaranty as to how much the additional depth in the channel would amount to.

It is a noticeable fact, however, that the greatest velocity and the bulk of the discharge of tidal waters are through the area near the axis of the navigable channel, and while this area would not have an opportunity for swinging as extensively as before the jetty was constructed, there would still be ample room for it to swing within the contracted angle with most of the defects of the original conditions.

The height to which such a north jetty would have to be built is considerable of a problem. If built only to low water, there is no possible doubt that great quantities of sand, stirred up by the waves from the northeast winds and storms, would be driven against the north side of the jetty and eventually go over it, and, if the jetty be considered to be gradually raised to high water, there is no apparent reason why, if the jetty were perfectly tight, the sand should not overtop the jetty to a considerable distance above high water—to the height, for example, of the sand dunes on the adjacent beaches. If the jetty were not tight, or was left low near the shore, as has been customary on this coast, it is certain that great quantities of the sand would go through and over it, which would be sure to drive the channel to the south and reproduce present conditions, with probably a moderate increase in depth all over the bar, but with no certain increase in depth in the channel. Dredging would certainly be necessary, and probably to almost as great an extent as under present conditions without any jetty at all.

For these reasons the improvement of this bar by a single jetty is not recommended.

(3) A SINGLE CURVED BREAKWATER.

The theory upon which this kind of structure is based was first put forward by Prof. Lewis M. Haupt, in about 1887, although some of its principles are involved in a curved, detached jetty, claimed to have been proposed by Mr. H. C. Ripley, assistant engineer, for Galveston Harbor, in about 1883. A jetty, not detached, but involving the curvature principle, had been previously constructed on the south side of the channel at Aransas Pass, Texas. It was constructed mostly under the supervision of Mr. Ripley, and he was associated with the engineer officer in its design.

The only example of a curved breakwater for bar deepening that has been built is on the north side of the channel at Aransas Pass, opposite the curved jetty, above mentioned. It was built by private parties in 1895-96. The consulting engineers who designed this work were Professor Haupt, Mr. Ripley, and Mr. G. Y. Wisner. The literature upon the subject, written mostly by Professor Haupt, is too voluminous to quote in this report. The essence of it may be found in the following documents, viz.:

- (a) Physical Phenomena of Harbor Entrances. Am. Phil. Soc., 1888.
- (b) Dynamic Action of the Ocean in Building Bars. Am. Phil. Soc., March, 1889.
- (c) Harbor Bar Improvements. Journal of the Franklin Institute, July, 1889.
- (d) Report of Board of Engineers on Aransas Pass, Texas. House Ex. Doc. No. 137, 55th Congress, 2d session.
- (e) The Reaction Breakwater. Proceedings Am. Soc. C. E., September, 1899.
- (f) Discussion of same, November, 1899.
- (g) Reaction Breakwater at Aransas Pass. Lewis M. Haupt, in Proceedings Am. Phil. Soc., 1899.

The following extracts from these documents are sufficient to illustrate the theory of the action of the structure:

JOINT LETTER OF MESSRS. LEWIS M. HAUPT AND H. C. RIPLEY, CONSULTING ENGINEERS
(DOCUMENT (d), PAGE 33).

PHILADELPHIA, June 12, 1895.

GENTLEMEN: In accordance with your request, through Brewster Cameron, esq., we have the honor to submit the following brief description of the proposed breakwater for Aransas Pass, Tex., and the results we confidently predict from its construction:

The work will be entirely of stone, or of stone with a thin brush mattress extending under a portion of a whole of its length, which will be 6,200 feet. In section it will have a top width of 10 feet, rising to a height of 3 feet above the plane of mean low water. The slopes will be $1\frac{1}{2}$ horizontal to 1 vertical, and the base will vary, according to depths, from 40 to 70 feet.

In plan it will differ from the usual form of a jetty or breakwater, being detached from the shore and located on the bar to the "windward" of the channel. Its axis will be curved (compound and reverse) to produce reactions similar to those found in the concavities of streams, and having radii sufficient to maintain channels of the requisite depths, as revealed by existing curves and their resulting depths of over 30 feet, now found inside the bar. It is designed to fulfill the fundamental conditions of (a) arresting the littoral drift; (b) admitting the full tidal prism to the interior lagoons; (c) controlling the ebb currents and producing a reaction across the bar; (d) changing the conditions of equilibrium of flood and ebb currents in favor of the latter; and (e) of according aids to navigation by a structure of only half the length of the usual convergent or parallel jetties in pairs.

The work will be executed in two parts. The first will consist of 1,250 feet of completed breakwater and 2,500 feet of foundation extension; the second, of 5,950 feet of completed breakwater and 250 feet of foundation extension. It is to be covered with a substantial apron of heavy blocks, weighing from 2 to 5 tons, carefully placed so as to produce a permanent and substantial structure.

The construction of the proposed breakwater, as designed, will unquestionably result in securing navigable depths over the bar of 15 feet for the first part of the work and 20 feet for the second.

The development of these depths will commence immediately upon the construction of the foundation course, which will be greatly hastened by the strong currents resulting from the "northers," and which occur between September and March. If a more rapid development of depths is desired than will result from natural causes, deepening may be facilitated by dredging or other auxiliary appliances.

Since the forces necessary to maintain a channel are much less than those required to create it, a channel once developed and protected from silt, as this will be, may be maintained by the natural tidal currents from the bays; hence the cost of maintenance under the plan proposed would be a minimum.

Respectfully submitted.

LEWIS M. HAUPT,
H. C. RIPLEY,
Consulting Engineers.

From this letter the essential points of such a structure appear to be:

1. That it must be located upon the side of the channel from which the drifting sands come so as to intercept them and keep them out of the channel.

2. It must be detached from the shore so as not to interfere with the full tidal prism entering the harbor.

3. It must catch and control the greater part of the ebb current, and by constantly deflecting this current in its passage across the bar cause greater scouring effect than would be produced by a current of the same velocity traveling in a straight path.

There are other objects to be attained by the breakwater given in this letter which are not very clear. The breakwater has to be curved "to produce reactions similar to those found in the concavities of streams and having radii sufficient to maintain channels of the requisite depths."

Presumably this means "having a curvature sufficient" because, from the theory, the greater the radius the less the reaction. It is taken to mean that where a certain curvature inside the bar produces a certain depth, the same curvature in the breakwater will produce a depth on the bar reasonably near the depth inside.

The breakwater must "change the conditions of equilibrium of flood and ebb currents in favor of the latter." This may cover some principle beyond the three given above, but it is too vaguely stated to admit of discussion.

Primarily it may be stated that the mere analogy between a curved stream and a curved breakwater has too many points of dissimilarity to directly predicate results from the use of the latter upon conditions existing in the former. A stream has two banks, both continuous. The reaction breakwater furnishes only one bank and that discontinuous. The bends and bars of a stream are constantly changing and both advancing with greater or less rapidity downstream, the stream being the agent that cuts the caving concave bank, and also the bearer of materials to constantly build the convex bank opposite. The breakwater is not at all analogous to this.

The first and second of the above principles (or the (a) and (b) conditions of the above letter) are also in one respect directly contrary to each other. If the drifting sands are driven toward the back of the breakwater, so that it resists their progress and stores them, it can only do so throughout its own extent. In the open space between its shore end and the shore there is nothing to stop the sand from being driven directly into the channel, since drifting sand is almost invariably driven diagonally shoreward along the coast, and under ordinary conditions this would drive much more into the channel than would be stopped by the breakwater. This fact appears to be recognized by Mr. Wisner, one of the consulting engineers for the breakwater at Aransas Pass, who states (Document (f) above, page 819):

The action of the littoral current in flowing past any system of jetties is to pile up the sand drift in the angle of the shore and jetty on the windward side. * * *

This sand would be driven into the channel on the side next to the breakwater. This is a most important point for consideration.

While in the case of Aransas Pass, with reference to which work the above letter was written, there is opposite this gap a south jetty, consisting of the riprapped head of Mustang Island and the old Nelson and Government jetties, yet, it must be remembered that the theory of the reaction breakwater allows for no such second jetty, and we must, in discussing it, assume that the side of the channel across from the gap is composed either of bar or beach or other erosive material, otherwise the reaction breakwater would be merely a second jetty, its mate being otherwise provided.

Assuming then that large quantities of sand will be driven into the channel through the gap and that it will all stop on the side next to the gap, the ebb currents must be assumed to wear this away no faster than they wear away the side of the channel opposite, so that both sides may be expected to wear away in the restoration of the channel width which has been narrowed by the sands driving through the gap. There is nothing, therefore, to prevent half of the sand thus eroded being gradually deposited between the channel and the breakwater, the channel location changing to correspond. If this process were continued long enough the channel would be perfectly free to move

so far away from the breakwater that the latter would have no effect whatever in increasing the erosive power of the current across the bar, or of "changing the conditions of equilibrium in favor of the ebb." Even without the gap the second jetty would be necessary.

This is illustrated in the diagram (fig. 1), which is an exact enlarged copy from a paper by Professor Haupt on the reaction breakwater as proposed for the opening of the Southwest Pass of the Mississippi River. The diagram gives the condition that Professor Haupt expects would result from the construction of the curved jetty as shown. The arrow has been added to show the direction of the current as it approaches the region of the jetty. This current would strike the shore near the point marked A. Impinging thus against the bank of soft mud at that point it can not avoid eroding it, and there is nothing to prevent its ultimately leaving the proposed channel and going in some such direction as A-B, without any reference whatever to the curved jetty.

From these considerations it will be seen that it is absolutely necessary for the success of the reaction breakwater that it be considered as a jetty, whether detached from the shore or not, and a second jetty of greater or less length built to insure the impingement of the current upon the breakwater. The length of this second jetty is an important matter for consideration, but for the present it appears plain that the reaction breakwater, if successful, must have a twin jetty of some kind to help it.

There is another important point which deserves consideration, i. e., the danger that if the breakwater be successful as a jetty its curvature may bring the deep water so close to itself as to endanger it from undermining and to endanger shipping attempting to use the channel.

Professor Haupt says (Document (e), above, p. 513):

5. It should also be so adjusted, with reference to the axis of the discharge, as to receive the same tangentially and train it across the bar without creating abrupt points of incidence, causing inequality of depths and, at the same time, not producing so much compression as to cause undermining and ultimate destruction or large expense for maintenance.

The problem of producing compression on a current is rather a novel one, and the writer does not feel called upon to discuss it; but taking this paragraph to mean that the curvature should be so great as to cause a good channel, but not great enough to cause a good channel dangerously near the jetty, it must be said that these are conditions that will probably, in practice, be very difficult to fulfill, and no prescription for fulfilling them is given in any of the various papers on the subject.

Professor Haupt also says (Document (f), p. 836):

The currents are molding their own channel, with a thalweg about 500 feet from the axis of the work and parallel thereto.

The Government survey of 1900 shows that the thalweg in the deepest places was only about 100 feet from the jetty, and the latter, near the outer end of the completed structure, had suffered quite seriously, apparently from undermining, the crest from A to B (fig. 6) having settled from 5 to 10 feet.

If it is intended by the theory to state that the breakwater is to create 15 or 20 feet of water 500 feet from the axis of the jetty by the analogy of a curved stream, it must be said that the writer has been unable to discover streams whose cross sections show any such

result. The deep water produced by the bend of a stream is almost always quite close to the shore, almost too close frequently for sheltered river navigation, and altogether too close for the safety of navigation or the maintenance of the structure on an ocean bar. At Aransas Pass to-day there is probably a minimum depth of 15 feet, with over 20 feet close to the jetty, yet the pilot at that place recently informed the writer that he was "willing to take out a ship drawing 12 feet, provided he had a good tide."

So much for the theory of the reaction breakwater. Let us now consider the practical application of the theory at Aransas Pass to determine—

1. Whether or not the structure is in accordance with the theory.
2. What has been accomplished since its construction.
3. What causes have contributed to the existing improvement in depth at that point.
4. Its applicability to Brunswick Bar.

According to Professor Haupt (Document (f), p. 848)—

The writer has laid it down as the first desideratum, viz, to keep the littoral drift from entering the channel. A jetty on the far side does not meet this condition, and is therefore no anticipation of either the principle or its application.

It is therefore of primary importance to determine whether the breakwater has actually been located on the "windward" side of the channel or not. To determine this we must first determine which way the resultant sand movement is—to the north or to the south—noting that the shore line at this point runs a little east of north. The writer is of the opinion that, while there is a movement at different times in each direction, the great preponderance of the drift is from south to north, and that the jetty is located in direct contradistinction to this primary principle of the theory. The testimony upon this subject is quite conflicting, but a careful analysis of it will show that the resultant movement is very large and is to the northward.

Since the revetment of the head of Mustang Island, in 1889, the direction of the ebb current has been almost due east, at right angles to the coast. It has, therefore, comparatively little effect in moving sands up or down the coast. On the other hand, the current flowing into the entrance at flood tide must come, owing to the shape of the head of Mustang Island, more from the northeast than the southeast. This would tend to carry to the south the sands that are north of the entrance, and, to a lesser extent, would carry to the north the sands that are south of the entrance; but the rise of tide is very small and this current, unaffected by winds, very gentle. It would, therefore, have a very moderate effect, if any, in either direction. The Gulf Stream flows past this entrance at a great distance—about 150 miles off-shore—and its current in this part of the Gulf is very gentle, so that neither this current directly, or any eddy from it, can have any particular effect in moving sand at Aransas Pass. The only thing left to cause a movement of importance is the wind. Both the currents produced by the wind and the waves to stir up the sand will act in a direction with the wind, and, making due allowance for velocity, the direction of prevailing wind must be the controlling element in the sand movement.

The Government Weather Bureau has kept very careful records of wind movement at Corpus Christi, Tex., only a few miles from the pass. The record for the last ten years, for which reports are pub-

lished, has been examined, and "southeast" is given as the prevailing direction for every year, and for 94 out of the 120 months concerned. This is precisely the wind to produce the maximum effect of stirring up and moving sand to the northward. Going into the details of these records, it is shown that during the ten years the wind blew from the north for 1,185 observations and from the northeast 482 observations, making a total of 1,667 half days on which these winds prevailed. But the north wind, it must be remembered, would have comparatively little effect in moving the sand to the south. The wind to be very effective must be slightly on shore. On the other hand, the wind blew from the southeast 3,445 observations and from the south 467 observations, giving for these winds a total of 3,912 half days, but here, on the other hand, the south wind is less effective and the southeast wind very effective. From this it appears that southerly winds were about two and a half times as prevalent as northerly winds, and that southeast winds prevailed about seven times as much as northeast winds. The average of the maximum velocities given for northeast gales is 43.7 miles per hour. The corresponding average for the southeast gales is 34.2 miles per hour. The average velocities from the different directions are not given in the tables, but the average velocity for each month is given without regard to direction. Taking the ten months in which the greatest number of southeast observations are given, the average velocity is 14.8 miles per hour.

For the ten months of greatest number of northeast observations it is only 10.9 miles. These observations show, therefore, no great predominance of velocity in favor of the northerly winds to counterbalance the vast predominance of direction in favor of the winds from the south. When it is borne in mind that the sands here are very light and easily set in motion, consisting mostly of comminuted shells, and that the wind is generally strong enough to keep the breakers in a constant roar and the sand constantly stirred up the greater part of year, these wind observations alone make it impossible to conclude that the sand movement can be to the southward.

As bearing on this subject, Mr. E. L. Corthell states (Document (f), p. 807):

One purpose of the Aransas breakwater is to "arrest the littoral drift," and for this purpose it is built on the "windward" side of the channel. The author presents no data to show that the "windward" side is the north and east side. The writer's recollection is that the preponderance of winds is from the south and west, and that the winds and the currents are up the coast during most of the year. However, that is a matter of fact to be ascertained from the anemometer records at Aransas or Galveston. As to currents in the Gulf of Mexico, the writer believes the following to be generally the conditions:

The current enters through the Yucatan Channel and goes out through the Florida Channel, so far, at least, as surface currents are concerned. The former moves up the coast, hugging it in the Bay of Campeachy, past the mouth of the Coatzacoalcas River at the Isthmus of Tehuantepec, past Vera Cruz, and then begins to spread out into the great area of the Gulf. Nearing the mouth of the Mississippi, but still some distance off, it gathers itself together for its passage through the Florida Straits, its velocity gradually becoming greater. All along this part of the coast there is a reactionary or eddy current which moves in the opposite direction, and which is felt as far west as Galveston and the mouth of the Brazos, though with much diminished force. At Aransas there is no appearance of the Gulf Stream for probably 150 miles off shore; it is opposite the widest expansion and the slackest current of the Gulf Stream. The winds cause the currents, and but little reliance can be placed on the westward drift.

On the head of Mustang Island the writer observed recently that the shallow bay near the life-saving station is rapidly filling with sand

brought in by the wind. The position of the fill, and the testimony of residents, indicate beyond doubt that it is coming almost entirely from the southeast, although sand could blow into it from the northeast.

All these facts point almost conclusively to the predominance of the sand drift to the north.

As evidence upon the other side, the following statements appear:

Mr. G. Y. Wisner states (Document (f), p. 820):

1. The littoral current, during a season when effective, flows from the northeast to the southwest.

He gives no facts upon which this statement is based.

He also says, same document, p. 821:

2. The sand moved along the coast by the littoral current, when stopped by jetties extending into the Gulf, accumulates in the angle formed by the east jetty with the shore.

The writer has examined every available chart showing jetties on the Gulf coast, and, with the possible exception of Galveston, finds the indications precisely the reverse of this. Mr. E. M. Hartrick, assistant engineer, of Galveston, states that his observation agrees with the writer's, and that he is positively of the opinion that the sand movement is to the north and east. This accumulation of sand is particularly observable at Aransas Pass, where there has been a very large accumulation of sand south of the jetties and an enormous scour to the northward.

Mr. Thomas B. Pitts (Document (f), p. 833), speaks of the sand "carried along the shore to the northward," and also says the curved jetty was designed "not only to protect the channel from the inflow of sand from the north," which movement he considers "more important than that from the south," etc., but he gives no facts upon which he bases this latter opinion.

Professor Haupt states (Document (f), p. 837):

Suffice it to say that the accumulation of drift on every jetty built in the Gulf furnishes suggestive evidence as to the correctness of the location of the breakwater.

The writer does not wish to disparage any carefully observed data, but in these problems the elements are so varied in different parts of the same inlet and are changing so constantly (every hour almost) that even a very large number of simultaneous observations, extended over long periods, will not furnish as authentic a record as the chronographic resultant engraven on the plastic material molded by the forces themselves. Careful comparative surveys are indispensable for this purpose, as well as measurements of the forces which have effected the results. A study of such charts, at various dates, is of more value than a few instrumental observations of velocities of currents, winds, or tides, all of which, however, have a relative value. The writer's conclusions as to the resultant direction of the littoral drift were more fully set forth in previous publications. It is largely a resultant of the angle of wave approach, configuration of shore line, tides, wind, etc., all of which cooperate to produce the effect. At Aransas the consensus of opinion, as well as the efficiency of the work done, point to the fact that the littoral drift is southwesterly. The small spur, 600 feet long, built in 1869, was a strong pointer.

This reasoning is somewhat vague. As a matter of fact, "the accumulation of drift on every jetty built in the Gulf" indicates that the breakwater is not located on the "windward" of the channel.

While the shape of the plastic materials upon which the forces act is undoubtedly a good indication of what the forces must have been, yet in this case complete surveys, extending any distance north or south of the entrance, do not exist, and the interpretations of the results is thereby rendered somewhat difficult, but what observations there are—for example, the fill south of the channel and the scour north

of the jetty—are strong indications of the sand movement to the northward, coinciding with and confirming the direct observation of the forces at work.

This scour back of the jetty is very important. Taking a strip 3,000 feet wide, the charts (see figs. 2 and 6) show that since 1895 1,270,000 cubic yards of sand has been scoured away, and it becomes important to determine where it has gone. There are three possible suppositions, viz:

1. It may have gone directly seaward. The maps, however, show positively that it has not.

2. It may have been driven by the northeast winds and currents into the gap between the breakwater and St. Josephs Island, which is what would be expected, and, as shown above, would be a very injurious thing if the sand travel was to the south. If this enormous mass of sand has been driven in through this gap, the record of its passage would certainly be left in irregular contours, sand waves, small channels, etc., but there is absolutely no indication of this (fig. 6). There has been a slight filling in this vicinity, owing to the fact, as recognized by Mr. Pitts (Document (f), p. 834): "There has been no tendency to scour in this opening; in fact the depths have decreased somewhat, and there has been a slight deposit of material owing to the lack of current," but the contours are, and have been in the meantime, very regular, only slightly changed from what they were when the breakwater was completed to its present state. This is almost positive evidence that the large mass of sand missing from behind the breakwater has not gone through that gap.

3. It might have gone to the northward. In fact this is where it doubtless has gone, though the evidence of the fact is mostly negative. The surveys do not extend far enough north to show positively whether the erosion back of the jetty has been at an abnormal rate, causing an accumulation just above, or whether the general movement northward along St. Josephs Island has obtained without showing any special accumulation at any one spot.

Of course this sand can not have gone to the south over the breakwater; otherwise there certainly would have been a fill close behind the latter.

The statement that "at Aransas the consensus of opinion, as well as the efficiency of the work done, point to the fact that the littoral drift is southwesterly" does not appear to be capable of being substantiated. The following persons familiar with the work, viz, Mr. E. M. Hartrick, assistant engineer, Galveston, Tex.; Mr. Hinkle, superintendent, United States Engineer Department, Galveston, Tex.; Mr. D. M. Picton, Rockport, Tex.; Pilot Mercer, Tarpon, Tex.; Ex-Governor T. B. Wheeler, of Texas, and several others have stated that in their opinion the drift was to the northward, most of the statements having been made to the writer in person.

A sea captain at Rockport stated that he, on one occasion, in attempting to go south to the mouth of the Rio Grande River with a sailing vessel, capable of sailing quite close to the wind, found a current to the north so strong as to very seriously impede his progress. He made a tack of about 60 miles out to sea and back again with a gain of about 3 miles, whereas had he been opposed by the wind alone, without the current, he would have made at least 15 miles.

Nor does the "efficiency of the work done" point to the fact that

the littoral drift is southwesterly. This efficiency should show itself in this respect by impounding sand behind the breakwater, or on its north side. Professor Haupt claims this:

The partially controlled currents have actually removed about 400,000 cubic yards of compact sand from the bar without the aid of a dredge or other mechanical appliance, and have prevented the deposition in the channel of a much larger volume driven along the coast by the angular wave movements.

The theory, therefore, which has been successfully applied at this admittedly difficult and unpromising location, was to protect the bar crossing near its weakest point from the drifting sand by a resisting mass of rock so placed as to develop a continuous reaction across the bar by the ebb currents, preventing their expanding over the entire external sector and conserving the energy of the effluent stream until it reached the deep water of the Gulf.

As means to this end the breakwater is detached from the shore to permit the tidal compartments of the inner bays to be filled freely by each flood; it is also composed of curves whose radii and centers are adjusted to the site in such manner as to cause deposits on the outer side of the structure, thus reinforcing it, and scour on the inner side, where an excess of foundation material revets the slope, and a peculiar order of construction is adopted, whereby the scour is assisted by gravity and the advance of the bar seaward is prevented.

All these results appear to have been fully secured by the work thus far done, as is shown by the Coast Survey report of February, 1899.

This is correct as far as the amount removed from the channel is concerned, the cause of which removal will be discussed further on. But the statement that the work has "prevented the deposition in the channel of a much larger volume driven along the coast by the angular wave movements," and that the work is "adjusted to the site in such a manner as to cause deposits on the outer side of the structure," is wholly at variance with the fact that, on the contrary, as shown above, an enormous scour of over a million and a quarter yards had taken place "on the outer side of the structure." This fact was fully indicated by the Coast Survey map referred to by Professor Haupt in the above quotation. (See figs. 2 and 5.)

Professor Haupt's statement—"the small spur, 600 feet long, built in 1869, was a strong pointer"—is taken to mean that the increase of 2 feet in depth on the bar caused by this spur was due to the fact that the sand traveled south, but the connection is not evident. It more probably acted as a second jetty in connection with the head of Mustang Island.

From the above facts it appears certain that the curved breakwater at Aransas Pass is not built in accord with the principal element of the theory of its action, and whatever results have been accomplished must be explained on some other basis.

Taking into consideration all the structures, natural and artificial, existing at Aransas Pass, it seems plain that most of the operation is that simply of two jetties, one somewhat longer than the other, its curved shape possibly making up in part for the lack of length in its mate. The first of these jetties—the north one—is composed of two parts, one of which is a natural bank extending from St. Josephs Island to the inner end of the breakwater, a distance of about 1,700 feet, measured from "base" (fig. 6), the formation of the outlet and the trend of the currents being such that no artificial structure is needed here to maintain this. For a farther distance east, of 4,650 feet, we have, in the breakwater itself, a more or less complete, actual jetty, with a little foundation beyond this. Opposing this, and forming the south jetty, we have, first, the revetted head of Mustang Island and the old Nelson jetty, extending from the same base to a distance of

about 3,150 feet. Beyond that we have the old Government jetty, a submerged structure, but still a jetty, capable of exercising an important influence on the tidal flow, a further distance of 2,350 feet; making a north jetty having a total length of 6,350 feet, and a south jetty having a total length of 5,500 feet, and located about 1,250 feet apart, this distance narrowing with the increasing depth on the old Government jetty toward its outer end.

It will be noted that the effective part of the north jetty is opposite the ineffective part of the south jetty, and vice versa.

The defects of both these jetties are overcome by directing the current against the effective part of each in turn. Thus, the ebb current issuing from the bay first strikes the revetment on the head of Mustang Island—perhaps the strongest and most thoroughly executed piece of work in the vicinity; thence it is deflected by the aid of the Nelson jetty (fig. 2) so that it strikes the breakwater between D and A, thus reducing the importance of the lack of strength in the natural bank forming the inner end of the north jetty and of the lack of height of the old Government jetty, now forming the outer part of the south jetty. This arrangement may effect some saving in original jetty construction, but it is dangerous both to shipping and to the stability of the structure and has further defects which will be pointed out further on.

Theoretically, the breakwater is supposed to deepen the channel by a new principle, viz, reaction, and not by the usual method—concentration of flow.

In short, it aims to utilize the well-known centrifugal force by the reaction developed by the resistance caused by a continuous change of direction so often manifested in the concave bends of streams, instead of the principle of concentration which has been relied upon so largely in the system of twin or convergent jetties, with such meager results. (Document (e), p. 507.)

An examination of fig. 2 will show that the concentration principle is used in this case sufficiently, in all probability, to cause all the deepening that has taken place. The ebb current issues from the pass with a velocity frequently of 6 feet per second. This, and the shape of the opening, naturally keeps it from spreading much till it reaches the point G. Before the breakwater was built this current was free to spread over the angle G_1GG_3 —about 63 degrees. The breakwater limits it now to G_1GG_2 , only 26 degrees. This is certainly concentration pure and simple. Mr. Pitts, who helped build the breakwater, clearly recognizes this when he says (Document (f), p. 832):

Until this last work was done between D and E the ebb discharge was practically not controlled at all, most of the flow passing to the northward of D, and the current across the bar was scarcely appreciable.

Under present conditions, then, the current will be concentrated and strong when it arrives at H. Here the same process is repeated. The water which formerly could escape through the angle H_3HH_4 —about 34 degrees—is concentrated in H_1HH_3 . The direction of the current G-H, and the velocity with which it arrives at H, together with the concentration caused by the total obstruction by the breakwater of the angle H_3HH_4 , and the partial obstruction of the angle H_1HH_2 by the old Government jetty, cause the concentrated current to strike the breakwater somewhere near C. From C to A it is more or less concentrated between the old Government jetty and the breakwater. From C to B the breakwater is at an angle with the direction

of the current, and its curved shape undoubtedly causes the breaking up of the current into eddies to a greater extent than would obtain in a current of the same velocity flowing in a straight line and increasing its scouring power. This is what it is understood Professor Haupt's "reaction" means.

It will be noticed that it is at this point that the greatest deepening has taken place and that it is dangerously near the jetty (fig. 6).

This deepening near the jetty at this point has doubtless been also partially caused by another fact, viz, the northward drift of the sand and the fact that the outer half of the breakwater has no south jetty opposite it of sufficient height to stop the sand south of the entrance. This sand has therefore aided in driving the channel close to the jetty and at the outer end forced the channel to shift across the jetty itself. Part of the deepening has doubtless been due to this latter condition, it being in this respect an example of the action of a single jetty on the far side of the channel, as proposed by Major Symons at Coos Bay and elsewhere.

It may be remarked here incidentally that the above forcing of the channel across the north jetty is a result of precisely similar conditions to those at Cumberland Sound, Georgia and Florida, which has been mentioned in some of the above literature as an exemplar of the bad effects of concentration by twin straight jetties (Document (*f*), pp. 819 and 842). In both cases we have a mass of drifting sand passing over or past an inefficient jetty on the "windward" of the channel and forcing the latter across the line of the other jetty, the latter in each case consisting of a mere foundation.

The failure of the consulting engineers to grasp the actual existence of the concentration principle at Aransas Pass jetties has given rise to some curious explanations of conditions resulting from the construction of the breakwater.

In the joint letter of Professor Haupt and Mr. Ripley, quoted above, they make a confident prediction of results:

The work will be executed in two parts. The first will consist of 1,250 feet of completed breakwater and 2,500 feet of foundation extension.

The construction of the proposed breakwater, as designed, will unquestionably result in securing navigable depths over the bar of 15 feet for the first part of the work and 20 feet for the second.

The development of these depths will commence immediately upon the construction of the foundation course, which will be greatly hastened by the strong currents resulting from the "northers," and which occur between September and March.

The conditions at the commencement of work are given on fig. 2, there being 10 feet on the bar.

All of the "first part of the work" was done, as prescribed, between August 1 and December 31, 1895. In addition, a part of the second part was also done in the spring of 1896, and the balance of the work needed to bring the work to its present condition was done in August and September of 1896. (Document (*f*), p. 831.)

The results of this "first part of the work," with the addition of quite a percentage of the second part, are given on fig. 3, showing conditions on August 8, 1896, there being 6 feet on the bar—a net loss of 4 feet.

To account for this failure of promised results, the following explanation appears:

Work on the Government jetty, which was of mattresses covered with rock, practically ceased about 1885, when it extended seaward, including the shore end, 5,400

feet, and a few years later it was officially reported to have "disappeared." * * * (Document (g), p. 138.)

The channel depths increased rapidly until, in November and December, a channel of 13 feet could be traced across the bar. (Document (f), p. 831.)

Unexpected obstructions.—It then transpired that the remains of the old Government jetty, which was reported to have "disappeared," were still in place covered with rock, crossing the bed of the channel and intersecting that portion of the curved reaction breakwater then in place about its middle point. * * * It thus acted as a submerged mat or retaining wall to prevent further scour, and as the breakwater subsequently rose, by the deposition of rock, to a plane 3 feet above the surface a perfect cul de sac was formed for the accumulation of sand. The harbor company was strenuously urged to remove the obstructing jetty, the existence of which was not suspected, as soon as discovered, but as it had made no provision for this unexpected work, either financially or in the contract, it was not removed. In consequence a shoal formed reaching to within $6\frac{1}{2}$ feet of the surface." (Professor Haupt, Document (g), p. 139.)

The discussion of this prophecy and explanation may be premised by the remark that the statement that the jetty had been officially reported as having "disappeared" is hardly complete. If it had disappeared by settlement into the sand or by being sanded over, its disappearance would not justify neglecting it as a factor in the problem, and there is nothing in the report in question to indicate that the stone, at least, was not still there, and nothing to indicate that the disappearance may not have been partly due to the causes just mentioned.

Furthermore, as the old Government jetty is shown on the map on which the consulting engineers laid out the breakwater (fig. 2), and as one of them, Mr. Ripley, if he did not design the old jetty, certainly made a survey of the work during its construction (Report of the Chief of Engineers for 1888, p. 1327), the unexpected nature of this obstruction is hardly patent. Moreover, since the map, fig. 2, shows 12 feet on the outer end of the old jetty when the breakwater was begun and the above explanation states that there was 13 feet before the shoaling took place, it is difficult to conceive of the nature of the cul de sac that could be formed by it to hold sand up to within 6 feet of low water. The insufficiency of this explanation is accounted for apparently by the consulting engineers failing to grasp the fact that the case was one of twin jetties and concentration of flow, what had happened being precisely what was to be expected in such cases.

By comparing the conditions of 1895, before work was begun (fig. 2), with those of August 8, 1896, after the shoaling (fig. 3), it will be seen that about 120,000 cubic yards of sand had been scoured from the channel inside the point D, and pushed out ahead of the ebb current into the area outside of D, forming a temporary shoal on its way to sea, which is what usually happens with twin jetties where the second one is rapidly constructed, as in this case.

This simple explanation was impossible to the theory of the reaction breakwater, which is supposed to thrust the material to one side, away from the breakwater, and not carry it to sea.

The exact whereabouts at the present time of the material which formed this shoal is somewhat indeterminate, as the old surveys do not extend south of the seaward end of the channel far enough to give accurate information on the subject. As far as they show, however, the indications are that it has gone to the outer slope of the bar, most of the 18-foot contour south of the end of the breakwater being about 550 feet farther seaward now (fig. 6) than it was in 1895 (fig. 2).

This is exactly as was to be expected with twin jetties, bearing in mind that the outer end of the south jetty is wanting, and the materi-

als thus permitted to spread out unduly. The direction of the current as it leaves the end of the curved breakwater is such as to force the material to the south to some extent against its tendency to drift northerly, the effect of the southeast winds not being so great at 18-foot depths as in shallower water.

The de facto existence of two jetties at this place, as well as their necessity, appears to have been unconsciously accepted by one of the consulting engineers, Mr. Wisner, who states:

A short spur will be necessary at the west side of the pass to prevent the reverse current from the littoral eddy carrying sand into the channel. This spur should be built above high water as far out as the wreck *Mary*, and will tend to limit the action of the eddy and diminish erosion on the front of Mustang Island. (Document (f), p. 819.)

It is to be noted that at the time this was written (October, 1899) Mustang Island was not eroding at all near this jetty, but was rapidly building seaward, from sands apparently being driven up the coast from the south. The recommendation does not say how far beyond the wreck *Mary* the spur should be built to a lesser height than high water.

It may be remarked that to construct a reaction breakwater at Brunswick, similar to that at Aransas Pass, and to provide a similar short spur, extending to a point proportionally near the outer end of the breakwater, would require a spur a little over 3 miles long. It would only take an addition of 2,500 feet beyond the wreck of the *Mary* to make a complete pair of twin jetties at Aransas Pass.

It will be proper here to discuss the claim that the reaction breakwater alone will not cause the bar to advance seaward, but on the contrary will roll it over to one side out of the way.

Professor Haupt states, in a paper to be published in the Journal of the Franklin Institute, concerning the application of the reaction breakwater principle as applied to the Southwest Pass, Mississippi River (p. 5):

From a depth exceeding 40 feet, the bed rises 14 feet in less than 1 mile, or 1 foot on 360, thence it flattens in the next 2 miles to 1 on 690, running nearly level for several thousand feet and suddenly dropping off with an outer slope of about 1 on 12 to the 35-foot contour. Thence it deepens rapidly to over 70 feet within a half mile.

This profile is characteristic of a delta bar rolled seaward by a sedimentary river. All the material passing over it must first be dragged up the inner slope by friction or be carried in suspension by the ebb stream. With the bar removed the resistance to the transportation of sediment would be greatly reduced, and if a lateral instead of a longitudinal movement be imparted to it, the path will also be shortened and the work required of the current be still further diminished. In short, the bar would be rolled over laterally instead of being pushed out into the Gulf in front of the jetties.

This inner slope up which the material has to be dragged has a maximum grade of 1 foot in 360.

Under the supposed conditions after improvement a quantity of material arriving at C (fig. 1) to be rolled sideways would have to go on about the line CD, which from the 40-foot contour up to the 20-foot contour, has an average slope of 1 on 125 and a maximum much steeper. Considering the fact that the cross current can hardly be as strong as the direct ebb current, it is difficult to see how "the work required of the current" will thereby "be still further diminished." This part of the theory therefore does not appear very reasonable. It has never been given a practical test.

The Aransas Pass structure is claimed as a test and a successful one,

but it has been shown above that it is not a test of the reaction breakwater theory at all, as it is on the wrong side of the channel and has a very extensive *de facto* jetty as a mate.

The claims made for it in respect to not moving the bar seaward will hardly stand examination.

Professor Haupt says:

* * * The bar had not advanced seaward [1897] but was eroded on its inner scarp, which is a great desideratum in this class of work. Now [February, 1899] the 12-foot contours are cut through and but a few hundred feet separate the 15-foot contours, etc. (Document (g), p. 140.)

This statement is correct so far as it goes, but it fails to state that the erosion of the inner scarp had not at that time moved the bar seaward because it had heaped up the sand on top of it, and that when this was scoured out and better depths obtained the material was carried out to the outer scarp and deposited, thus advancing the bar seaward, the 18-foot contour outside having moved seaward, as shown above, about 550 feet.

Mr. Wisner says:

Particular attention is called to the fact that the breakwater at Aransas Pass was constructed under the plans of the consulting engineers, without causing the bar to be pushed seaward the slightest measurable amount, an achievement which has never been accomplished at any other port on the Gulf coast. (Document (f), p. 820.)

It is not known upon what evidence this statement is based. It was written in October, 1899, although at the time of the Coast Survey examination of the entrance, seven months before, the 18 and 21 foot contours, just south of the prolongation of the breakwater, had each been pushed seaward about 400 feet (figs. 2 and 5), and similar conditions, to a less degree, had been shown by the harbor company's survey of 1897 (fig. 4).

In August, 1896, the point of controlling depth (fig. 3) was 5,200 feet seaward of the line marked "base" on fig. 6. Six months later (fig. 4) this point of controlling depth had moved seaward 1,000 feet and there are no indications whatever of the bar being displaced laterally to the side opposite the breakwater, and a comparison of the two maps referred to indicates simply that the increased current, due to the concentration of flow caused by the two jetties, was pushing the bar seaward.

An endeavor to lay out a reaction breakwater at Brunswick Bar in accordance with the theory of Professor Haupt is shown on fig. 7, on the line E-F. The various curves are proportional to those used at Aransas Pass, the breakwater being enlarged to fit the larger bar. This is apparently the best location that could be selected, and is in the closest practicable accord with the theory.

It will be seen that it produces a condition of affairs totally different from that at Aransas Pass. At Brunswick the drift of the sand is mostly to the south, although, as at other places, there is a movement in both directions. While the sand movement is considerable, as shown under the discussion of the method of improvement by dynamite, yet it is so opposed by the direction of flow at the exit that the rate of change in the channel location is very slow. Assuming the breakwater to be built, as at Aransas Pass, to one foot above *high* water, (Document (e) page 513, par. 8), its cost is estimated at \$1,833,778, making no allowance for extra foundation to prevent undermining.

Assuming such a breakwater to be constructed, let us consider what would happen. The space between its shore end and the shore of St. Simons Island, a distance of about 2 miles, is now free to the tidal flow, and the contours show northeast channels across that area, which indicates that considerable of the tidal flow takes that route.

The prevailing winds and storms from the northeast, stirring up the sand to the north and east of this area, must inevitably drive it into the channel the same after the construction of the assumed breakwater as it does now. The eroding power of the ebb being directed mostly against the north side of the channel, as pointed out above, the sand is carried out to sea almost as rapidly as it is deposited, being, in all probability, largely distributed on the south face of the north shoal, near the bar proper, thus causing this shoal to advance to the southward. This advance is also increased by the sand that is driven directly over this part of the shoal from the northeast. With the breakwater in position this latter contribution to the southward growth of the shoal would, for a time at least, be cut off, and the shoal could be expected to advance for a time somewhat more slowly; but there is little to indicate that it would stop advancing, much less than it would wear away to permit the channel to follow along the line of the breakwater. In fact, the area under the lee of the breakwater (the latter being assumed as raised to high water) would apparently be a protected spot where sand could settle and its accumulation would gradually force the channel to the south, eventually leaving the breakwater out of the question.

And even if the channel happened to be at present so shaped that the breakwater could be located with proper curves immediately alongside of it, or if by some fortuitous chance the channel should change so as to follow the breakwater, there is apparently not the slightest obstruction to the above-mentioned gradual deposition of sand north of the channel opposite the inner portion of the breakwater, and just so soon as this occurs there is absolutely nothing to prevent the channel turning off to the south away from the breakwater.

To imitate the conditions as they now exist at Aransas Pass and construct a south jetty to reproduce conditions caused by the head of Mustang Island and the old Government jetty, including Mr. Wisner's spur out to the wreck of the *Mary*, would require a jetty above *high* water from the shore near the point A out to somewhere near the point marked M (fig. 7), the distance from M to the outer end of the breakwater bearing the same relation to the distance from the shore of St. Simons Island to the outer end of the breakwater as the corresponding distances at Aransas Pass bear to each other. This spur jetty, from A to M, would be nearly $3\frac{1}{2}$ miles long, and if built only to *low* water would cost \$1,300,000.

Supposing this arrangement to be adopted, we then have a total cost of over \$3,000,000, with the necessity of the ebb current handling all the sand driven into the channel from the northeast through the large gap, and with no protection of the channel against its being driven too close to the breakwater in its outer half by sands driving northward during southeasterly storms.

The sequence of events under this construction would probably be about as follows: During northeast weather sand would be driven into the channel and carried seaward. The south jetty or spur would hold the channel close to the inner half of the breakwater, and the curve of the outer half would probably also keep the channel alongside of it.

Most of the sand would be deposited in the open space south of the outer half of the breakwater. Being under the lee of the latter, it would not be driven southward at the normal rate in northeasterly weather, but southeast winds would be free to drive it northward and thus narrow the channel. Some of it would inevitably go seaward and form a new bar. On the whole, the outlook would be decidedly unpromising. But even supposing that a channel of a certain depth that could be depended upon would be created, the arrangement would be radically deficient in two particulars, viz:

First, the necessities of commerce might call for a deeper channel. The only way to provide it would be by dredging, and there is no positive indication that any less dredging would be called for to maintain a certain increased depth than would be called for without any jetty work at all. The initial dredging necessary to produce a given channel would, of course, be less, but it might fill in at such a rate that the total dredging for maintenance would not be much less than now. The arrangement would not protect the channel as twin jetties do.

A second and more serious objection is that all plans for increasing bar depth must provide for their extension seaward. A small increase in the length of the breakwater on its seaward end, with the corresponding increase in curvature called for by the theory, would bring the outer half of the breakwater parallel with the coast or directed toward shore—a condition wholly inadmissible.

CONCLUSIONS.

The following conclusions may be reasonably drawn from the above discussion:

First. The theory of the reaction breakwater is fatally defective in the following particulars, viz:

(a) It provides for no force or resistance to hold the current against the breakwater. Such provision would usually mean a second jetty.

(b) Should it increase the depth, such increase is limited, and beyond that an undue amount of dredging would probably be necessary.

(c) If successful in deepening the channel it would probably move the bar seaward, and the seaward extension of the works appears impracticable.

(d) It makes no provision against the channel being driven too close to the breakwater for the safety of itself or shipping by sand coming from the opposite direction, or by the current being directed against the jetty in accord with the theory.

Second. The only apparent example of such construction that has been tried is at Aransas Pass, and this is no test of the theory at all, as the breakwater is not located according to the theory, and the beneficial results produced are not the result of the reaction breakwater as such, but by incomplete twin jetties.

For these reasons a single reaction breakwater is not recommended for the improvement of Brunswick Bar.

(4) TWIN JETTIES.

The theory upon which converging or parallel jetties have been used is about as follows:

It is observed that between the headlands inclosing the entrance at most tidal harbors there is a very deep and comparatively narrow

gorge. As the tidal water goes seaward, however, it is free to spread, which spreading is accompanied by great shoaling. Apparently by building jetties with a width on the bar in proportion to the width of the gorge, depths sufficient for navigation would be produced.

Apparently if all the ebb tide is concentrated between the jetties on the bar, and their width apart is equal to that of the gorge, the conditions of the latter would be reproduced on the bar. This would require jetties to high water. Usually the depth of the gorge is far beyond the requirements of navigation, and if high-water jetties, with the width at the gorge were built, not only would unnecessary depth be attained but the jetties would be in danger of undermining, and an excess of sand would be carried seaward, with the danger of forming a new bar. Moreover, jetties to high water are expensive to build and difficult to maintain. Jetties can be built of small rock to about low-water mark, but above this point the violence due to storms increases very rapidly, so that larger blocks and more expensive construction are needed.

In view of these facts the width between jetties on the bar has generally been made greater than at the gorge, and the height has generally been limited to near low-water mark. With this system of construction, however, it has been found on the South Atlantic coast that the scouring effect has generally not only failed to reproduce the depths at the gorge, but has not produced depths great enough for navigation. A very important object has, however, been attained by such jetties, i. e., the channel location has been fixed so that very satisfactory dredged channels can be maintained, making it possible, at comparatively moderate cost, to widen and deepen such channels as the needs of navigation require. Charleston, S. C., is a good example of this. Here, though, the jetties were long under construction, and to some extent pushed the bar seaward, and failed to entirely scour out the desired channel, yet, by the aid of dredging, the channel originally planned has been created, and its maintenance involves only a comparatively small expense, and the estimates for very materially deepening it are quite moderate.

The principal benefit of this system is certainty of results and definite location of channel. On the other hand, it is not improbable that in some cases the interest on the cost of the jetties added to the cost of the dredging actually done would have created and maintained channels superior to those produced. This is a question of fact, which must be determined and estimated for in each particular case, as the conditions always vary. At Charleston the jetties have cost about \$4,000,000, which cost includes about 2,200,000 cubic yards of dredging, the cost of which has been about \$400,000. The jetties have caused a scour of about 3,000,000 cubic yards, which, however, is distributed over a channel with a width unnecessary for navigation. The interest on the cost of the jetties at 3 per cent amounts annually to \$108,000. This, together with the cost of the dredging actually done, would probably have paid for enough dredging to have created and maintained a better channel than now exists, but possibly not so definite as to location and perhaps more variable as to depth.

The Charleston jetties have been left low near the shore for the double purpose of economy in construction and to freely admit the flood tide to avoid reduction in the tidal prism. It is not unreasonable to believe that the quantity of dredging necessary and the quantity of sand that has been scoured seaward has been materially increased by sands driven over the low portion of the north jetty by northeast

storms. Such sand may be expected to be driven into the channel, usually over both jetties, if they are left low, even though the predominance of sand movement is decidedly in one direction. Jetties built to a height sufficient to stop the sand flow from both sides and also high enough to control the tidal flow should be expected to reproduce at the bar the depths at the gorge, which depths may be reduced by increasing the width of the jetties, in which case the material moved seaward to form a new bar is limited to that originally found between the jetties and is not subject to constant increase by sand coming over the jetties.

Apparently the only examples of such high-tide jetties in the United States are at Sabine Pass and Galveston, Tex., and Yaquina Bay, Oregon, and at the latter place only is the tidal range of any magnitude. These jetties at Yaquina Bay have increased the depth from 7 feet to 15 feet at mean low water, and, so far as the records show, without as yet producing any new bar seaward of the jetties. The peculiar tides on the Pacific coast, however, are especially favorable to the action of jetties.

The jetties so far constructed at Cumberland Sound have not yet progressed sufficiently far to have much influence upon the bar depths, and those at the St. Johns River, Florida, are only partly completed, but, considering present prices for dredging rather than those obtainable when the projects were made, the indications at both places are that a better channel could have been secured by dredging than by jetties at the same ultimate cost.

Brunswick Bar is especially unfavorable for jetty construction, and especially favorable for dredging. The lines A-B and C-D (fig. 7) would constitute a properly located pair of jetties for the improvement of this bar, the distance apart being about 4,000 feet, which is wide enough for safety against undermining, and would be expected to give depths increasing with the heights to which the jetties are built. These jetties, however, are very long, the south jetty being about 30,000 feet and the north jetty about 25,000 feet. The cost of high-tide jetties, which might be expected to create and maintain an ample channel, would be prohibitory. Jetties to low tide could be expected merely to preserve the channel location and reduce the cost of dredging. The estimated cost of these, as stated above, is \$1,311,810 for the north jetty, and \$1,517,798 for the south jetty, making an aggregate of \$2,829,608. The interest on this sum at 3 per cent would be \$84,888.24 per annum, or probably much more than enough to annually create by dredging the channel depths and widths required by the act.

For this reason the improvement of Brunswick Bar by twin jetties is not recommended.

(5) DREDGING.

The objections that have hitherto existed against dredging ocean bars are based largely upon the meager results obtained by expending small amounts in creating narrow channels to be soon filled up by drifting sands. Nowhere in this country has dredging been tried on a scale at all commensurate with the large sums expended on other methods. Nowhere has enough bar dredging been done to determine the very probable fact that persistent dredging will gradually cause a concentration of the tidal flow in the dredged channel accompanied by

a shoaling elsewhere on the bar and a very valuable scour in the channel itself.

As was shown above, under the head of "Dynamite," the partial improvement of Brunswick Bar by dredging, while it has been very expensive as to the rate per cubic yard, has been quite successful as to the permanence of the improvement. The present conditions of the channels are shown on fig. 8, which indicates only a very slight deterioration since the time of the previous survey, shown on Map O.

The recent improvements in dredging machinery have reduced the cost of this class of work to very low figures. At Liverpool dredging on a large scale has been done at $2\frac{1}{2}$ cents per cubic yard, counting everything except interest and depreciation of plant. This sand was carried to sea and dumped 4 miles from the place of dredging. At Natal, South Africa, similar dredging has been done at $4\frac{1}{2}$ cents per cubic yard, working in free sand and depositing the dredged material from 1 to 2 miles at sea. This price includes cost of dredges, interest on cost, and maintenance.

All things considered, in the present state of the science of bar improvement, dredging appears to be by all means the most economical and satisfactory method for work at this place.

The sailing lines of the present or Goodyear channel are shown along the line G-H (fig. 7). This channel can be improved to 26 feet at mean high water for a width of 200 feet, the figures required by the act, by the removal of 272,136 cubic yards, which, at 15 cents per cubic yard, would cost \$40,820.40. This channel, however, is unnecessarily crooked and the sailing ranges unnecessarily numerous. A harbor of the probable importance of Brunswick should have a straight range over the bar, in line, if possible, with the light-house. Such a range is shown on the line K-L (fig. 7). A channel of the above dimensions on this line will require the removal of 431,000 cubic yards, which, at 15 cents per cubic yard, would cost \$64,650. The exact line for dredging, however, should be determined by conditions existing when the dredging is begun. It is quite probable that a more advantageous line, slightly farther to the south of the line K-L, may exist in the near future.

The mere creation of the channel called for in the act, while it will temporarily aid shipping entering Brunswick Harbor, will not be sufficient for the needs of commerce. The channel will require maintenance, and it should also be located with reference to future widening and deepening. With these facts in view, mere provision for the creation of the channel called for would be an unwise policy. Provision should be made for the economical creation, maintenance, and increase of the channel. This can best be done by the construction and operation of a suitable dredge owned by the Government. Should the channel suddenly shoal such a dredge will always be available for deepening it, whereas if contract work is depended upon a great deal of time would be lost in advertising and getting a suitable dredge to the ground, in addition to the much larger appropriations required to do the work.

Moreover, there are strong reasons against doing any ocean-bar dredging by contract. The class of dredges required for this work can not be used advantageously for any other class of work, and there is no ocean-bar dredging done for private parties. The Government is the only patron of seagoing dredges. Ordinary dredging is done in large quantities for private parties, for which numerous dredging

concerns are needed, and the Government is only one client out of many that such concerns may have, and there is room and opportunity for real competition on an economical basis.

On the other hand, in sea dredging, if private parties own the dredges and the Government has work for them all, there can be little competition. If there are enough dredges for competition, a number of them must be lying idle most of the time, the expenses of which idleness must in the long run be borne by the Government. Therefore the Government should own and operate such seagoing dredges as are necessary, and not call upon contractors for such work at all.

A special reason for doing this particular work by a Government dredge exists in the fact that large projects for dredging on the Atlantic coast are now under way and in contemplation, aggregating probably more than the existing dredges can handle at reasonable prices, which fact will require the construction of additional dredges by private parties, and probably result in great increase in prices.

For these reasons it is recommended that an appropriation of \$150,000 be made for the construction of a dredge, together with \$25,860, which is the estimated cost of removing the above 431,000 cubic yards at 6 cents per cubic yard, for which price it can readily be done after the dredge is provided.

There are appended to this report details of the estimates given above (Appendix No. 4), and a copy of the report on the survey of Brunswick Bar, by Mr. James H. Bacon, assistant engineer (Appendix No. 5).

Very respectfully,

CASSIUS E. GILLETTE,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., January 3, 1901.

Respectfully submitted to the Chief of Engineers, United States Army.

Without indorsing in toto all the views of the district engineer as set forth in his able and lengthy discussion of the improvement of Brunswick Harbor, I do concur fully with him in the opinion that Brunswick Harbor outer bar is peculiarly adapted for improvement by dredging. I also concur with him in that the best results can be obtained in the most economical manner by the method he suggests of the Government itself owning and operating the dredge instead of letting the work by contract. I would suggest, however, that in addition to the \$150,000 for the dredge, sufficient money be appropriated for at least two years' operation, instead of one year's as recommended by the district engineer. In other words, that an appropriation of \$200,000 be made for the construction and operation of the dredge for two years.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

APPENDIX No. 1.

BRIEF OF MR. C. P. GOODYEAR, CONTRACTOR WITH THE GOVERNMENT OF THE UNITED STATES TO DEEPEN THE OUTER BAR OF BRUNSWICK, GA., BY EXPLOSIONS OF DYNAMITE ON THE BOTTOM AND UNDERNEATH THE BOTTOM OF SUCH BAR, AND BY THE USE OF AUXILIARY MEANS TO SMOOTH AND LEVEL THE BOTTOM OF SUCH BAR.

I.

Prior to 1879 a wide and deep channel entrance through the outer bar of Brunswick existed, of nearly 23 feet at mean high tide, nearly 900 feet wide, the depths being nearly uniform for a distance from deep water on the inside to deep water on the outside of said bar of about four miles. See Lieutenant (afterward Commodore) Stockton's report to the Secretary of the Navy in 1826, and report of Commodores Claxton, Woolsey, and Shubrick to the Secretary of the Navy in 1837, and Coast Survey reports and charts from 1857 to 1879.

II.

In 1879 the *Sunbeam*, a deep-draft sailing vessel, sought to cross the outer bar through this channel upon a falling tide, and was wrecked in mid-channel, where she remained long enough to start a shoal, reducing the depth two (2) feet.

A new channel, tortuous and difficult of navigation, opened around such shoal. The wreck in a heavy storm was moved to the south and west several thousand feet, where it is now indicated by the No. 3 black or "Sunbeam wreck" buoy.

III.

The new channel thus opened, though two (2) feet had been lost, answered the purposes of the commerce of Brunswick existing at that time, but in 1880 the city commenced to grow in population and volume of commercial business rapidly.

IV.

In October, 1889, the *Alpharetta Campbell*, a large vessel loaded with railroad spikes and fastenings, was wrecked in this remaining channel, and the hulk thus imbedded in six months caused such shoaling that the existing channel was obliterated and covered by the north-breaker shoals, thus barring the further use of deep-draft vessels in the commerce of the port and threatening grave disaster to the city of Brunswick.

V.

At this period the best available depth at mean high tide for a commercial channel over the bar, which consisted now of a continuous shoal extending from the north breakers on the north to the shore of Jekyl Island on the southwest, was composed on its surface of a series of shell reefs, with underlying strata of pure blue clay, and was limited to eighteen (18) feet.

VI.

Brunswick had grown from a population in 1880 of 2,900 to 10,000 in 1889, and its total annual exports and imports of 1880 amounting to \$1,711,688 to \$7,900,838 in 1889. (See report of Capt. O. M. Carter to Secretary of War for 1895, page 1500, vol. 2, part 2.) This flattering increase of business was threatened with destruction unless immediate effort were made to restore the deep water upon the outer bar.

VII.

I aroused the city authorities to the importance of this matter in the spring of 1890, with the result that a survey was authorized by Congress, which began in December, 1890, and was concluded in June, 1891.

VIII.

Meantime the volume of tonnage over the bar was rapidly increasing, and, due to the former reputation of the port for deep-water facilities, an increasing number of deep-draft vessels were being chartered, the charterers doubtless unaware of the

changed conditions on the bar. The impossibility of such vessels taking on their full specified cargoes, and the numerous long delays to such even as loaded to the reduced drafts designated by pilots awaiting extraordinary spring tides, some as long as seven weeks, led to vexatious controversies between shippers, charterers, and underwriters, which pointed unfailingly to irreparable loss of prestige to the port.

IX.

Due to this condition, exports and imports, which were \$7,900,838 in 1889, fell in 1890 to \$7,363,167. (See Captain Carter's report, 1895, vol. 2, part 2, page 1500.)

X.

Deeming it vital to our commerce that immediate steps should be taken to procure deep water on the bar without awaiting the slow processes of procuring Government aid, I urged the mayor and council to have a thorough investigation made to ascertain whether it were possible to find a deeper channel over the shoals than commerce was using.

Such an investigation by skillful men was made, demonstrating that from the north breakers on the north to Jekyll Island on the south no better water could be found than eighteen (18) feet at a mean high tide. I then urged the mayor and council to procure a dredge and seek temporary benefit by that means. The effort was made, but, due to the fact that all the sea dredges suitable for this work not in use elsewhere were either at Panama or Nicaragua, it was impossible to procure one.

XI.

I then urged the mayor and council to try some experiments with a view to temporary benefit. They did not feel justified in expending municipal funds upon mere experiments.

XII.

I then thought of dynamite as a tremendous force used to tunnel mountains and mines and to make railroad cuts, and determined to make an application of this force as a means of procuring a deepening of the water on the bar. This was put into effect by means of a fund of \$1,500, raised by myself and four other gentlemen equally enthusiastic, to make the experiment.

Three weeks' explosions revealed a marked deepening over the shoals, and the mayor and council thereupon provided \$6,500, with which the work was continued from July 8 to August 22, 1891, resulting in the procurement of an increased depth of a foot and a half. And on the 18th of August, 1891, the ship *Agra*, which had been detained fifty-six days, and but for this improvement would have been compelled to discharge part of her cargo, crossed the bar with a draft of twenty feet and nine inches without touching.

XIII.

At my suggestion further work was suspended in order to determine whether the results obtained were to be permanent. An examination on November 24, 1891, and another by the Coast Survey in June, 1892, demonstrated that the results remained unchanged and were permanent.

XIV.

In the spring of 1892 the financial crisis was approaching. The mayor and council were involved in the common calamity, which reached the proportions of bankruptcy in 1893, and were unable to continue the work.

XV.

Satisfied that these emergency efforts had led me to a great discovery of a new and powerful force for the dispersion of ocean bars, I determined, if I could procure any sort of legislation from Congress, to go on with the work.

XVI.

Experimental legislation was procured, and on August 5, 1892, I resumed work, procuring an increased depth, but not such as entitled me to compensation under the act.

XVII.

Three surveys were made by the Government engineers, none of which declared the depth required by the act or depth as claimed by me, but vessels were now continually crossing the bar of drafts demanding the depth of water I claimed.

XVIII.

By the experimental legislation referred to, the statute of limitations was upon my right to continue operations on January 1, 1893.

XIX.

In February, 1893, I sought legislation reimbursing me in part upon a *quantum meruit* for the benefit already secured to the commerce of the port and permission to continue work until November, 1893. The former was not granted, but the latter was, and over the opposition of Captain Carter, of the Engineer Corps, who then and since then has urged the people to abandon support of my work upon the argument that no large appropriations could be secured for the improvement of Brunswick Bar so long as the people sustained me in the work by my methods. The people chose to sustain me because they were getting improvement yearly which was self-maintaining.

XX.

The commerce of the port increased, owing largely to the improvement of the bar, from \$7,363,167 in 1890 to \$12,756,760 for 1891; and while it fell off in 1892 and 1893, owing to financial depression and reduced values of the bulk of exports, as well as the prevalence of an epidemic of yellow fever, the figures had again, in 1894, amounted to \$13,489,831. (See Captain Carter's report, vol. 2, part 2, pages 1493 and 1500, Chief of Engineers, 1895.)

XXI.

In June, 1893, after having twice raised funds for prosecuting the work and depositing twice in succession in banks which failed before I could draw checks against the same, I raised the money a third time and continued work until, on the 12th of August, 1893, I was forced to suspend operations by the yellow-fever epidemic, and was unable to resume until September 4, 1894, since which time, with short intervals, due to financial trouble and to permit Government surveys, I have steadily continued to work.

XXII.

There have been nine periods of suspension of work, viz: August 22, 1891, to August 8, 1892; from January, 1893, to June, 1893; August 12, 1893, to September 4, 1894; March, 1895, to May, 1895; July to August, 1895; December, 1895, to August, 1896; December, 1896, to August, 1897; December, 1897, to September, 1898; December, 1898, to May, 1899.

XXIII.

Whenever work has been recommenced there has been increase of depth, as is clearly shown by a list of deep-draft vessels, showing their sailing dates, drafts, rise of tides, tonnage, &c., during 1891, '92, '93, '94, '95, and '96.

XXIV.

It is a remarkable feature of the improvement by this method that no shoal has formed seaward or inward during the progress of this work. The littoral currents created by winds have carried the material southerly in north and northeast winds, and northerly in southeast and southerly winds, thus building natural breakwaters, which aid in controlling currents channelward and in assuring reasonable permanence of channel depths.

XXV.

I have accidentally, in the emergency which confronted our city in 1890 and 1891, made a great discovery of an entirely new and effectual method of deepening an ocean bar. I challenge investigation of all recorded history of harbor-deepening since

harbor-deepening was begun to show a single instance, from the days of the Roman Empire, at least, until to-day, where with like outlay of money such uniform, continuous, and such considerable and rapid improvement reasonably self-maintaining like this has been procured.

XXVI.

This work has created a river in the open ocean five miles from land, not injuriously affected by storms or currents, ten feet deeper than existed when I commenced work, at the point where the channel crosses through the bar; seven feet deeper than existed at any point across the bar when I commenced work; a river which requires only such reasonable and moderate outlay for maintenance as is required for all ocean bars which are successfully deepened. It is a work which ranks in its beneficial results with the successful bar-deepening in this and other countries, which has been procured by the outlay of millions of dollars, and no such results except with generations of labor, expenditure, and effort, and the entailed burden of frequent dredging to maintain depths procured, whereas my work, while showing immediate response to efforts to further deepen, at the same time, when left to itself, reasonably maintains its depth, so that commerce can steadily use it, as tested by long intervals of suspension of work in two instances, over one year at a time.

XXVII.

This is the second instance in the history of ocean-bar deepening in this country where the work has been done at the risk of the contractor, Mr. Eads' work at the Mississippi passes being the first.

XXVIII.

Parallels and differences between Mr. Eads' work and this:

Mr. Eads' work provided for ample compensation in event of success and ample compensation for maintenance yearly for twenty years. The compensation for this work has been small, and no adequate provision for maintenance to the man who created the channel has ever been made by Congress. Mr. Eads' work was prosecuted during a period of great financial depression. This work has progressed during a financial panic unsurpassed in the country's history.

Mr. Eads' work was suspended by a virulent yellow-fever epidemic. So was mine.

Mr. Eads was compelled to overcome general opposition and professional opposition and the opposition of contractors in like fields of effort by established methods by the only weapon available—namely, success. So have I.

Pamphlets were published, interviews in newspapers were had, to demonstrate Mr. Eads a visionary and enthusiast, and predicting his failure. The same was true of my work.

Mr. Eads was forced to borrow money at ruinous rates of interest, due largely to opposition which, not content with publication of newspaper interviews and pamphlets, sought, by personal interviews with those friends of his likely to help him, to deter them by the weight of professional opinion and prediction. The same was true of my work.

Mr. Eads demonstrated the success of his work to Congress in the face of adverse reports, and was paid as upon a *quantum meruit* for services performed to commerce, in advance of technical compliance with the contract, and afterward complied with his contract, which is true of this work.

Mr. Eads' methods had been tried, notably at the Danube delta, in Europe, and were in no sense new. Mine was the first effort to deepen an ocean bar with dynamite as the main agent. Both were successful.

Mr. Eads was unauthorized by legislation specifically to use a dredge as an auxiliary aid to the main method, namely, jetty control of the current. Did use a dredge. A board of army engineers declared it a proper auxiliary aid, inferentially declaring it a proper auxiliary to any scheme of harbor deepening, and have steadily used it since in all schemes of harbor-deepening under their control.

I was commanded to use auxiliary means for smoothing the bottom of the bar. Among other means I have for three of my eight years' work used a dredge. It has been recognized as a proper auxiliary with full knowledge of its use by the departments, and I have been paid as Mr. Eads was. Of the ten-foot gain in depth at point where new channel crosses bar but two feet have been obtained while a dredge was used, and eight feet were obtained before its use.

It follows that there is but one precedent for my work. His legislation stood upon its own merits. No rules of Congress were applied. New rules were created for new

methods of contract and execution. It was recognized as an act of justice to Mr. Eads that, in event he succeeded over the opposition and prediction of professionals and laymen, he should retain charge of the channel he had created and be allowed a reasonable yearly sum for its maintenance. So should it be in my case. In no event should such a channel thus created be taken from the man whose life has largely entered into its construction, whose pride in it is a strong guarantee of its maintenance, and placed in control of engineers of the Army who have predicted its failure from the first effort in 1891, and who, compelled to admit its success, now predict failure to maintain.

XXIX.

It has been asserted by parties who can have no motive but to create prejudice and take this work from my control after, at my risk and with my money, I have proved it a success, after eight years of effort and sacrifice, in the hope that they may in some way realize by carrying this work to a further success, not at their own risk, but by contracts with the Government for the removal of so many cubic yards of material, that I have been paid excessive amounts; that I have abandoned my original methods; that the material is not as represented.

XXX.

To the first of these propositions, that I have been paid excessive amounts, the answer is that the enterprise when all moneys have been paid leaves me heavily in debt, with a lucrative law practice and clientage necessarily abandoned, with my home heavily mortgaged; that no work of equal magnitude has ever been accomplished before in this or any other country for less than \$500,000, ranging from that to \$12,000,000. A tabulated statement accompanying this brief shows the average cost for a single foot of gain in depth in this country has been more than a third more than the Government pays me for seven feet of gain in depth.

XXXI.

To the second proposition, that I have abandoned my original method, namely, the use of dynamite, the answer is simply that it is untrue. Dynamite has always been used at each renewal of work, of which hundreds of people in Brunswick are reputable witnesses.

XXXII.

That the material is not shell, gravel, and sand compacted in concrete mass on surface and nonerosive, underlaid by a stratum of blue clay of five to six feet depth, through which I have now happily gone into a new stratum of shell and sand, except where I seek to widen channel, is proved by the testimony of a number of the best citizens of Brunswick, filed with Commerce Committee of Senate and River and Harbor Committee of House of Representatives, and by official report of a survey made under Captain Carter's direction in 1891, from which I quote:

"The material of the surface of the bar consists of about 70 per cent of medium gray sand and 30 per cent of broken shell, with traces of fine gravel, or rather of a coarser sand. This material is only three or four feet in thickness, and beneath it is found a dark-blue sticky mud, the depth of which is unknown, but is probably very great."

XXXIII.

But if it had been true that I had made large profits from this successful new method of deepening an ocean bar, which can not be patented because the principle involved was patented for use of dynamite for another purpose, the question should be, What has this method saved the Government? For what does the Government maintain a costly Patent Office, except to protect men's brains and thereby enable them for a term of years to reap large profit from their inventions? In what particular does such protection differ in principle from the application of a device to infinitely cheapening the cost of deepening outer bars? And why should not the man who has succeeded so liberally rewarded for his eight years and a half of effort and danger and financial struggle, opposed by the conservatism of laymen and professionals, and forcing recognition of the great value of the work by yearly increase of draft and tonnage of vessels and the quadrupling of the commerce of Brunswick in five years?

XXXIV.

The report of H. L. Marindin, the officer of the Coast and Geodetic Survey detailed to survey this outer bar by the Secretary of War, filed on the 4th day of December, 1899, shows a continuous channel through the bar of 25 feet and over at mean high tide, over 150 feet in width at the narrowest point, and of 24 feet deep and over at mean high tide, over 250 feet in width at the narrowest point, or an excess of widths of those depths over the contract requirements at the narrowest point of 50 feet.

XXXV.

The increased draft of vessels detained before I commenced work for favoring tides of 17 feet draft and over, from 11 in 1890 to 220 in 1898; of tonnage of those drafts, 16,572 tons in 1890 to 210,831 tons in 1898; the increased commerce of Brunswick from \$5,600,000 in 1893 to \$21,508,270 in 1898, compiled from board of trade records of Brunswick in tabulated form, accompanies this paper and tells a wonderful story of growth due to increased channel depths in a period of financial depression, the percentages of commercial increase being greater than for any port on the entire coast of the United States for the same period of time.

XXXVI.

An accompanying paper shows the opinion of Mr. Elmer L. Corthell, as eminent a riparian or maritime engineer as lives in this or any country, of my methods; and also the opinion of J. A. Bryan, a dredging contractor, of the value of this work; also extracts from standard works upon river, harbor, and bar deepening, laying down propositions applicable to such work, demonstrated to be true by wide experience of eminent engineers in all parts of the world.

XXXVII.

THE DIFFICULTIES ENCOUNTERED IN OCEAN-BAR DEEPENING.

The engineer who seeks to tunnel a mountain, dig a railroad cut, throw up a railroad embankment, or do any engineering work on land, has a problem which, after certain investigations, may be mathematically figured out, at a given maximum of cost and a maximum of time within which to complete.

Not so with the riparian engineer dealing with the problem of ocean-bar deepening. His work is hidden by the ocean, the most powerful and complex force existent, whose tides are high or low, as affected by attraction of moon and sun, by barometric conditions, by winds, which not only affect the height, but the direction of the currents. The conformation of the shore lines also affects the tidal range. Each ocean bar must be studied by itself, for each has peculiarities created by the local conditions. The conformation of the shore line, the tidal basin and its area and capacity for holding water, the portion of the water contained in the tidal basin which finds outlet to the ocean on each ebb tide, the depth of water and its width in the gorge between the islands or land entrance from the ocean, and thus its scouring capacity if it could be projected through the outer bar instead of being dispersed over wide areas of shoals in its progress on the ebb tide to the ocean; whether in the history of the bar and harbor there has been increase or decrease of the area and capacity of the tidal basin, the emptying of which on the ebb tide must be relied upon for the volume and velocity of current required to reasonably maintain a channel once secured through the outer bar; what changes have occurred or are occurring upon the bar itself, due to what causes; the prevailing winds, the proportion from each point of the compass, and the effect of such winds upon the ocean and tidal currents; whether the conditions are such as to warrant the erection of artificial walls or jetties to give direction to the volume of water from the gorge in a definite line through the outer bar; whether such works will not shut out too much of the flood tide from the tidal basin, thereby weakening the volume and velocity of current upon the ebb which is necessary to maintain any channel through the outer bar, and if not a source of danger, whether it is justified by its expense or whether the importance of the port will justify such outlay.

These are but a part of the data necessary for a determination of the course to adopt in procuring a reasonably stable channel outlet through an ocean bar, and to be studied for each bar by itself. To this must be added knowledge of how water runs, how it exercises its erosive power, its admiration for a curve, its fashion for deepening the concave and shoaling the convex side of a bend in all rivers; the fact that the estuaries which run through pure mud marshes even are never straight;

that when conditions force a river into a long, straight reach the depth is distributed equally over its width, and thereby and for other reasons it is shoaler than the channel portion of the river in the bend—a fact so well known to pilots that they frequently navigate rivers about which they have no knowledge by swinging from the concave of one bend to the concave of another.

So wide of the truth is the assumption that so many cubic yards dredged from a defined channel through an ocean bar will furnish the desired result of a certain depth and width, which may be relied upon for use by commerce, that the instances are rare where it has been relied upon in this country or Europe, or used except as an auxiliary aid, or to maintain channels procured by other means. In every instance in this country or Europe where dredging is relied upon to procure a channel it involves the expenditure of large sums in dredging plants and periodical renewals of dredging. The ocean is constantly at work upon erosive material, constantly moving it, and the problem is by some method to project through an ocean bar a sufficient volume and velocity of current to carry the material in suspension through the ocean-bar channel to ocean depths where littoral currents will distribute it and it will do no harm.

XXXVIII.

THE PROBLEM OF OCEAN-BAR DEEPENING AS APPLIED ON THE OCEAN BAR OF BRUNSWICK, GA.

I have given as intelligent study to the problems I have referred to as confronting the riparian engineer as was in my power, both from standard works and from all intelligent sources of local information touching this bar and its history, and with this and my personal observation and study of it, covering a period of twenty-eight years, I found—

That official examination from 1826 to 1879 showed a channel through this outer bar of about 23 feet at mean high tide, about 900 feet wide, maintained by a channel through the gorge between the islands of about half a mile wide, of maximum depths of 72 feet and minimum depths of 31 feet at mean low water.

That in 1879 a deep-draft sailing vessel, *The Sunbeam*, was wrecked upon a falling tide in this 900-foot channel; that, as is always the case with an obstruction, a shoal formed; that a new channel opened around this shoal, tortuous and difficult of navigation, of two feet less depth than the old, seeking outlet seaward of the wreck and shoal through the remains of the old channel.

That in 1889 another vessel, the schooner *Alpharetta Campbell*, heavily loaded with iron, was wrecked and sunk near the edge of this new channel, and that in six months this channel was entirely closed to commerce, the north breakers coming down upon and obliterating it, leaving as an outlet for vessels only the best water over shoals extending from the north breakers to the south breakers; shoals which were nonerosive by the currents, composed on the surface of shell, sand, and gravel, cemented together, with an underlying stratum of blue clay, equally nonerosive, with deepest water through these shoals in a tortuous channel of 18 feet at mean high tide. This material was very difficult of removal by any process.

I knew of my own knowledge that the passage between the islands had steadily widened, and learned from old settlers that this widening process had been going on since their earliest recollection. An official examination of the gorge in 1891 showed, by comparison with the surveys of 1857, the channel in the gorge had not only greatly widened, but deepened from 72 feet maximum and 31 feet minimum depths to 96 feet maximum and 58 feet minimum depths, showing as a necessary conclusion that more water was coming in and going out through the gorge; that the tidal basin had therefore increased, giving a greater volume, and therefore greater velocity of current, than existed when a 23-foot channel 900 feet wide was maintained across the outer bar. The increase in tidal basin is not only proved by the increase in width and depth of water passing through the gorge, but also by the invasion of salt water upon fresh-water areas in the inner harbor—a process which has killed large numbers of fresh-water trees on the banks of tidal estuaries, notably at Pyles marsh. Such process of invasion of the salt water upon fresh-water areas has steadily gone on during the entire 23 years of my life here, and the remains of fresh-water trees in tidal areas and in the marshes demonstrate that it had been going on many years before, and old inhabitants recall wide areas that were fresh-water lands in their childhood that are salt marsh with fresh-water trees dead and buried in the marshes.

I learned also that, due to the broad scope of waters in this great bend of the coast, winds from the north and northeast created southerly currents, and from south, southeast, and southwest, northerly currents. I reasoned that the old depths and widths of current in the gorge having maintained a channel 900 feet wide of 23 feet

depth, if I could open a breach through the bar inducing sufficient of this current from the gorge through it, instead of its escape over wide areas of shoals to the north and south, it ought to create and reasonably maintain for commercial use a channel of 25 or 26 feet of depth of 300 to 500 feet wide, even if there had been no increase in the capacity of the tidal basin and none in the channel widths and depths through the gorge, but that with such increase demonstrated by the official survey of 1891 it was certain that such a channel could be reasonably maintained, if once obtained, with only such expenditure for yearly maintenance as has been found necessary at all ocean bars which have been improved. I reasoned that the current was a great carrier of material; that these currents across the bar created by the winds ought to take the material away to the breakers on the north or the south and not seaward or inward to create a new bar. I reasoned that every portion of the bar which I could break down of a width as great as the channel width between the islands would tend to induce the water to seek the sea channelward, and I claim that deepening for a half mile wide of this bar has been valuable and necessary, as inducing more water channelward, thereby weakening the flow over wide areas of shoals to the southeast and northeast and through swash channels.

If this claim is justified, and I see no escape from the conclusion, then there have been removed in this half mile width through this bar effectively for the purpose sought not less than 1,500,000 cubic yards of material during the progress of my work. There has also been a great widening of the deep-water contours or pockets from the sea toward the bar, and from the gorge between the islands toward the bar, as I believed would be the case; while these inner and outer pockets have widened and deepened, the north and south breakers have built, justifying my belief that the currents created by winds would drift the material out of the channel to the north when the winds were southerly, south when the winds were northerly.

I found a bar with a channel of but 18 feet at mean high tide, tortuous and difficult of navigation, with such abrupt turns that a long vessel from 350 to 463 feet in length, such as now frequently cross this bar, could not have reached the sea through it, no matter how deep it might have been. At the turns they would have inevitably gone upon the shoals.

I have created a new and independent channel, which is certified by the Government, of 25 feet depth at mean high tide, through which vessels 463 feet in length and of 52 feet beam have crossed the bar to sea, due to the easier curves in the new channel than existed in the old.

I found a harbor with vessels detained for favoring tides in 1891, when I undertook this work, of but 17 feet draft. Vessels of 19 to 20 feet were detained for exceptional spring tides in numbers of instances as much as 6 and 7 weeks. Vessels of 24 feet draft have since crossed it.

The commerce of the port was for—

1893.....	\$5, 600, 000
1894.....	9, 940, 000
1895.....	12, 680, 000
1896.....	15, 674, 902
1897.....	17, 491, 719
1898.....	21, 508, 270

or a commerce nearly quadrupled in five years.

DYNAMITE AS AN AGENT IN THE DEEPENING OF OCEAN BARS—ITS SPECIAL ADVANTAGES EITHER AS A PRINCIPAL AGENT OR AN AUXILIARY.

Dynamite is a force not fully appreciated. We read of explosions of dynamite and its immediate effects at the point of explosion, the crater which it makes, but there is another effect—a vibration through the earth, which can be distinctly felt at St. Simons Island, $4\frac{1}{2}$ miles away, whenever a 100 or 200 pound charge is exploded on the outer bar. Vessels have felt this shock at long distances from the bar and not within sight of it, and masters and sailors without knowledge of the explosion of dynamite thought it was an earthquake shock.

In the blue clay, through which I worked $6\frac{1}{2}$ feet, it had the local effect of tearing it up, dissolving much of it, so that it was carried away long distances in the currents, and putting other portions into position in lumps, large and small, detached from the main body, which the currents gradually carried away, and St. Simons Island and Jekyl beaches were strewn with blue clay in larger or smaller lumps when dynamite was being exploded, and only then. But it is not this local feature of the use of dynamite which gives it great importance as a bar deepener, either as principal agent or as an auxiliary; it is the vibrations through the bar over wide

areas which change the condition of the material from nonerosive to erosive material, enabling the currents to take it up, put it in suspension, and carry it away. This is not a theory, but a fact. The effect of 100 and 200 pound explosions for thousands of feet away from the immediate scene of the explosion has changed the character of material, loosened it, and rendered it erosive. Repeated tests have been made when dynamite was not in use; then when it was being used, and this changed condition of material was in every instance discovered. It is this changed condition throughout the bar which enables nature to indicate where she wants the channel and the worker to conform to her views. Nature indicated where she wanted this channel the first year; although we were shooting dynamite several hundred feet to the south of the point she indicated, we could not break down the bar fully there to deep water on the seaside at the point where we were working. Soundings showed us that, at a point of less depth of 3 feet than where we were working, nature, aided by these vibrations, had broken through. We moved our work to that point and worked in harmony with nature, and speedily procured the total gain of $1\frac{1}{2}$ feet in navigable depth that year.

In 1892 a provision was placed in the act that a channel should be obtained to the north of this channel, and we through three months exploded dynamite north of this channel in the shortest line between deep water on the inside and deep water on the outside. We obtained no permanent deepening there, but in this channel which nature indicated deepening steadily went on. Nature has never indicated any other channel which she wants deepened. I have spent, when I knew less than I know now about this work, thousands of dollars on the north edge of the channel trying to take out a curve which would have made the channel a little straighter. Nature will not have it so. The curves through this bar which she indicated in 1891 she indicates still, and in recent years I work with her. She is willing that I should widen the channel, but it must be upon the same curves with the original narrow channel she indicated. Had I undertaken to deepen this bar with a dredge, there are other points of passage across it far shorter. I should have tried the short cut and it would have filled up. I tried the short cut twice in 1891 and in 1892, as above stated. Nature closed up the cuts I partially opened through the bar and continued to say to me, Here will I work with you and nowhere else.

If I had used a dredge she could not have told me this, for the material would have remained nonerosive where she wanted her channel, and her currents could not have eroded it and indicated her desire. The time will come when this effect of dynamite will be recognized. This is not the dream of an enthusiast for his pet project. It is the result of patient observation and experiment. Men in Brunswick who will believe nothing they do not see and test for themselves know this is why I have succeeded. I undertook to deepen Aransas Pass, Texas, in aid of Professor Haupt's curved jetty plan. I worked upon it but four months, in the winter of 1896 and 1897, and was compelled to abandon it through disappointment at Brunswick and inability to finance it. The same thing occurred. I found it with $6\frac{1}{2}$ feet of water. I left it with $9\frac{1}{2}$ feet. It had in every previous year during the summer months and prevailing southeast winds shoaled up. It has steadily increased in depth until there is now $15\frac{1}{2}$ feet of water—a gain of 9 feet. I used there nothing but dynamite. In the hard-packed sand of the Gulf at that point we could not force a $\frac{3}{4}$ -inch iron rod into the bottom when not shooting dynamite. When shooting it we could work an ordinary oar or pole down in it from 2 to 3 feet. On the Brunswick bar during progress of work large spar buoys were loaned me by the Light-House Board, which were subsequently in storms lost and paid for by me. As the channel was widened by the work it at times became necessary to move these buoys, which were held in place by mushroom anchors weighing 2,000 pounds each. When moved at times in which dynamite was not being exploded it was very difficult to break out the anchors, which had become embedded in the material of the bottom, with a powerful tug, and in three instances a large hawser was broken in the effort.

When dynamite was being exploded the material on the bottom was loose and the buoys were moved by the tugs with the greatest ease. Cross-section lines of soundings taken across the bar from the north breakers toward the south breakers, as well as cross-section lines across the deep-water pockets seaward and inward from the bar, showed widening and deepening. This deepening and widening is over areas of half a mile of width, and are all due to the peculiar vibratory action of dynamite and to the greater volume and velocity of the currents and their greater erosive power in channel lines caused thereby, the current being able to seek the sea that way instead of by wide dispersion over shoals north and south of this half mile of width. I have devoted so much attention to the theories upon which I have acted in the use of dynamite because there has been a general misconception of my theories and purposes in its use, namely, that I was relying upon craters created through the

bar to make a canal through the bar instead of creating a valley through the bar through which the ebb currents could be concentrated to do their appointed work. If that had been my only purpose, or if that and the breaking up of blue-clay deposits had been my only purpose—if my purpose, in other words, had been to create a mere canal through the bar of the width only named in the acts, 200 feet wide, leaving the shoals on each side of the channel of original depth—I frankly admit that I could have found other agencies than dynamite which would probably have accomplished that purpose more quickly and cheaply, but would not have procured for practical use what I was seeking.

I was seeking, as all successful efforts at outer-bar deepening must, a channel which commerce could rely upon with reasonable certainty and with a moderate outlay for maintenance, always required where such a channel is procured—a channel which would not be liable to fill up and be obliterated, or partially obliterated, in every severe storm, within such moderate outlay as could be hoped for at a port of the commercial importance of Brunswick when I commenced work. Such channel I have created. The Government, through its Light-House Board, removed its buoys to it in January, 1892. Each year of the work commerce has had the benefit of such increased depths yearly increased, until it is certified as 25 feet, against 18 feet at mean high tide of commercial depth when I commenced work. My method gave relief to commerce, threatened with destruction by the loss of 5 feet of navigable depth, to the extent of $1\frac{1}{2}$ feet in gain in depth the first year I worked and of yearly increase in depth, until in the year 1899 there were 7 feet of gain in navigable depth and 10 feet in the new and independent channel across the bar. The commercial increases heretofore referred to show how promptly commerce responded to this relief. It took 23 years to deepen the bar at Galveston so that commerce received any practical benefit; in the 5 years that have followed Galveston's commerce has been doubled. It took 15 of the 18 years' work on Charleston Harbor before commerce received any benefit; years of effort at Winyah Bay and Fernandina, and at the latter place the commerce of the port has been threatened with destruction three times—namely, in 1893, 1897, and 1898—and appeals have been made to the Government for immediate relief in the emergency to save the commerce of the port.

THE VALUE TO COMMERCE OF THE DEEPENING OF THE OCEAN BAR OF BRUNSWICK, GA.

There is but one just and fair basis of comparison by which to arrive at the value of the improvement of the outer bar of Brunswick, namely, What have such improvements cost at other ocean bars; what was the estimated cost for this bar; how long has it taken to procure the water here and elsewhere? The accompanying comparative statement of such cost and time might be extended indefinitely to improvements in this country and other countries, and the results would be substantially the same. It would show a practical improvement in daily use by commerce on the outer bar of Brunswick at infinitely less cost than any such work elsewhere in this country or other countries, and in less time than any Government work has taken upon an ocean bar on the Gulf or Atlantic coast, the cost to the Government of 7 feet of gain in navigable depth being less than one-half the average cost of a single foot of depth at ports compared in accompanying paper, the cost at Brunswick for 7 feet being \$220,000, the average cost per foot at six ocean bars on Atlantic and Gulf coasts being \$468,560, as shown by army engineers' reports.

RÉSUMÉ.

An ocean bar four and a half miles from land, more exposed than any on the Atlantic or Gulf coast, has been increased in navigable depth more than 7 feet; is a new and independent channel, with easy curves, through which the longest vessels can be navigated with ease; has been created by a new method, which, either as an original or auxiliary method, may be made of universal application at an infinite reduction of cost; is reasonably permanent, comparing favorably in that respect with any channel procured by other methods—leaves me \$25,000 in debt. I have procured an excess of width of 24 and 25 feet depth, at narrowest point of 50 feet. I ask pay for that in accompanying draft of proposed legislation at low prices, permission to continue and procure 26 feet, 200 feet wide, and compensation for yearly maintenance for ten years of 25 and 26 feet depths, \$7,500 for each of those depths of 100 feet wide, or \$30,000 per year if all are maintained, the lowest sum the army engineers have named for such maintenance at any port they have deepened.

Respectfully submitted,

APPENDIX No. 2.

LETTER OF MR. E. L. CORTELL.

NEW YORK, February 7, 1899.

Hon. WM. P. FRYE,
*Chairman, Committee on Commerce,
 United States Senate, Washington, D. C.*

DEAR SIR: The following remarks are upon the item in the river and harbor bill relating to the contract with C. P. Goodyear to deepen the sea bar at Brunswick, Ga.

I have been conversant of this subject during the past seven years. At my request Mr. Goodyear has sent me all the printed and other matter relating to it. He has also, by continual correspondence, kept me advised of the changing situations. This information reached me while abroad in Europe, as well as in the United States. I desired to have full knowledge for two reasons: 1st, for the purpose of applying the method to harbors where I might be professionally interested, and 2d, to assist him to obtain what the result of his work would entitle him to receive, both in respect to the approval of the engineering profession and just compensation from the Government.

As to the first, I have been so fully convinced of the correctness of the method that I have recommended it where the conditions were somewhat similar. As to the second, this is the first opportunity I have had to express my views to your Committee.

I do not propose to compare the results with those obtained elsewhere by the usual methods, or to go into details as to the value, commercially or financially, of his work, but to state the general principles, which I believe to be correct, and the results which have followed their application.

First. It must be noted that the work is a considerable distance out at sea and exposed to the full force of wave action, which is very heavy on this part of the coast. It certainly would not be economical to build permanent works were there any other method to ameliorate the commercial conditions.

I do not believe simply a dredge-cut would have been practicable, either to make (or at least at large expense) or to maintain, except under the protection of permanent dikes, as the sea is heavy for months at a time, and the waves would have filled up the channel so dredged. Such a narrow cut would not in any appreciable degree change the hydraulic conditions—that is, it would not have increased the volume or the velocity of the inflow and outflow of the tides across or through the bar. No useful results would have followed.

The work of Mr. Goodyear has changed those hydraulic conditions, and has considerably and permanently increased the volume and velocity of the tidal flow which is absolutely required for the maintenance of the deepened channel. In fact, the concurrent deepening and widening and general enlargement of the tidal channel as the dynamite work proceeded are results of the greatest importance.

The following statements and conclusions are based on charts and reports of the Government officers, on testimony before the Committee at previous hearings, and on the printed and written statements of Mr. Goodyear and other parties well qualified to make them, and upon a comparative chart and sections made recently by Mr. H. C. Ripley, civil engineer.

The subject will be treated under three divisions—Conditions, Work, and Results.

(1) *Conditions.*—A stormy sea bar $4\frac{1}{2}$ miles from land, over which, until comparatively recent years, there was a deep, wide, navigable channel. This channel about twenty years ago began to deteriorate in depth and width by interference with the tidal flow caused by wrecks upon the bar. The following are the depths at mean high tide at different periods up to the time when, the channel having become very restricted, crooked, and obstructive of commerce, Mr. Goodyear began to explode dynamite upon the bar to attempt to open a channel:

1826.....	23.0
1857.....	24.1
1878.....	23.0
1879.....	22.0
1889.....	18.0

(2) *The Work.*—The preliminary work above referred to was observed to have much more general and satisfactory results than were expected. Obtaining permission from Congress to proceed, Mr. Goodyear began systematic work on a large and adequate scale to make a still greater and a permanent enlargement of the channel by the same means.

During this work it developed that natural laws were greatly aiding the work, but that those laws required a channel in a location to harmonize with them, and this channel was then chosen for the work.

Granting that the material in the course selected could have been dredged, it was evidently too tough and nonerosive for the cut to have been enlarged by current action. The explosions of dynamite in large quantities shook up, disintegrated, and changed the character of the material over extensive areas, making it erosive or capable of being moved by the current and carried out and distributed along the shoals at a distance from the channel, this distribution being made by the littoral currents running north or south as the winds prevailing at the time directed them. The dynamite was exploded in large charges, varying from fifty to two hundred pounds, and in number of charges at one time from one to six. The total amount exploded to date upon the bar is about 160,000 pounds, or 80 tons.

This method of work often left the channel irregular and lumpy, and Mr. Good-year obtained consent of Congress to use auxiliary means to smooth the bed of the channel and remove the lumps. This was done by various forms of harrows and scrapers dragged by a tugboat, and to a small extent by hydraulic and mechanical dredges, either raising the material to the water surface for the currents to dispose of or else carrying it away and depositing it beyond the limits of the work. The amount so carried away was approximately seventy-five thousand cubic yards.

(3) *Results*.—From the time of undertaking the work up to the present time the depths of the navigable channel have been as follows:

The original channel in 1891 was 18 feet deep; the present channel is 24 feet deep. The width of the bar has diminished from 6,000 feet to less than 4,000 feet at the 25 feet depth.

The commercial results have been equally satisfactory, and have kept pace with the increasing depth.

The original channel was too crooked to be navigated safely by vessels of 300 feet length, even when their draft permitted; the present channel is much straighter and is navigated by vessels of 425 feet length without difficulty, one of 463 feet passing through several times without trouble.

The original channel passed in one year (1891) only twenty ships of a draft of 17 feet and over, and none over 20½ feet.

The present channel passed in one year (1898) two hundred and twenty ships of 17 feet draft and over, of which thirty-nine were 21 feet and over and two were 24 feet. The tonnage of the port of vessels drawing 17 feet and over has increased as follows: 27,108 tons in 1891 to 210,831 in 1898, and the value of the total commerce of the port from \$5,600,000 in 1893 to \$21,508,270 in 1898.

General physical results.—Outside, beyond the navigation channel, the tidal channel has undergone changes of great magnitude having an important bearing upon the maintenance of the navigation channel.

It was early noted during these successive periods of the work that deepening of the entire bar was going on, greater nearer the navigation channel, but quite considerable remote from it. Taking the areas within about a quarter of a mile of the navigation channel on either side, this progressive deepening has been about as follows:

1890	the depths were about	15.8, 16.8, 17.8, and 18.8
1892	“ “ “	16.8, 17.8, 18.8, and 19.8
1892 (fall)	“ “ “	17.8, 18.8, 19.8, and 20.8
1893 (January)	“ “ “	19.8, 20.8, 21.8, and 22.8
1898	“ “ “	21.8, 22.8, 23.8, and 24.8

The above are depths fairly taken at random from the charts.

In order to exhibit this important feature of the work, there has been prepared for me by Mr. Ripley a comparative or historical chart and sections which has just reached me and which I submit with these remarks.

These exhibits show a very considerable enlargement of the tidal channel both in width, lengthwise of the bar, and across the bar, between deep water inside and deep water outside. As to the latter, the great amount of material moved is seen from the profile, the first figure on the top of the blue print of sections; all space above the yellow line and below the white line represents material removed.

The cross sections 1 to 6 show enlargements of the tidal channel laterally.

The chart shows the same conditions, with indications that had the survey extended sufficiently far on either side of the channel a general enlargement half a mile in width would be apparent.

I consider that these enlargements measure the value physically of the work done more nearly than if the navigation channel alone is considered, because a result of this character by the radical enlargement of the tidal channel is absolutely necessary

for the permanence of the *navigation* channel. The amount of material removed from this latter channel can not be estimated, as the surveys have not sufficiently covered the bar area, but it is very large.

Mr. Goodyear will have received from the Government, upon securing the channels provided for by legislation already enacted, \$220,000. The cost of the work usefully done is therefore very small per cubic yard. The material *dredged* and *removed* from this tidal channel was about 75,000 cubic yards, or probably not more than 5 per cent of the whole amount removed. No doubt the future deepening of the *navigation* channel as proposed by him in the present bill will lead to a still greater enlargement of the tidal channel, so that the cost per cubic yard will, on completion of his work, not be greatly in excess of the cost per cubic yard up to the present time.

Observations and examinations made during the progress of the work show that the material removed from the tidal channel has been deposited on the north and south breakers on each side of this channel, really forming underwater banks or submerged jetties, which have no doubt aided in the development and maintenance of this channel.

One change of great importance has taken place concurrently with the development of the *tidal* channel through the sea bar by the enlargement of the *tidal basin*, or reservoir, inside the two islands that form the only entrance and exit of the tidal volume. If this enlargement is actually going on (I have no proof to offer except the statement of Mr. Goodyear, already made to your Committee), it furnishes an assurance of permanency of the *navigation* channel more definite and important than may at first appear.

It is well known in hydraulic engineering that a slight enlargement or diminution of a tidal basin will effect great results by increasing or decreasing the size of channels over sea bars lying miles out in the sea.

An illustration is the showing made by a distinguished American engineer before a committee of the House of Lords, of Great Britain, that the slight reduction in the tidal basin of the estuary of the River Mersey by extending the Manchester Ship Canal banks into it would decidedly and permanently shoal the depths on the Liverpool bar *sixteen miles out at sea*. The committee threw the project out of court, and it had to be reformed and reintroduced the next time on a plan avoiding the estuary altogether.

Therefore, considering all the facts above stated, it is evident that the work done and proposed by Mr. Goodyear is very needful, useful, and inexpensive. As he proposes to spend his own money and as he has relieved the commercial situation and increased the commerce of this important port, his request to proceed upon the same lines to obtain greater commercial facilities would appear to be a reasonable one.

I am, respectfully, yours,

E. L. CORTHELL.

27 PINE STREET, NEW YORK, *February 8, 1899.*

NOTE.—Mr. CortHELL is a member of the following societies: American Society of Civil Engineers; American Society Mechanical Engineers; American Institute Mining Engineers; The Canadian Society Civil Engineers; Institution of Civil Engineers of Great Britain; The Imperial Institute, Great Britain; The Institution of Engineers and Ship Builders of Scotland; French Society of Civil Engineers, and corresponding member of that society for the Northwest of the United States; The Mexican Association of Civil Engineers and Architects; honorary member of the Geographical and Statistical Society of Mexico; The American Geographical Society; National Geographic Society, Washington, D. C.; Boston Society of Civil Engineers; The Engineering Association of the South; Western Society of Engineers, Chicago; fellow of the American Association for the Advancement of Science; second vice-president American Society of Civil Engineers in 1888, first vice-president 1893 and 1894; president Western Society of Engineers in 1889; chairman 1891-1893 General Committee International Engineering Congress.

APPENDIX No. 3.

COMMUNICATION OF MR. J. A. BRYAN.

BRUNSWICK, GA., *8th December, 1898.*

I have read the article in the New York World of December 5, 1898, entitled "Serious charges in harbor contract," referring to Mr. C. P. Goodyear's contract with the Government for deepening the outer bar of Brunswick, Ga., and to charges preferred in relation to said contract by Donald McLean and Rittenhouse Moore, con-

tractors, and am surprised that such charges should be made by men who have no personal knowledge of the conditions existing on this bar or of the problem that Mr. Goodyear has solved. I have an intimate knowledge of this work for two years of its progress, and the only two years in which a dredge was used at all. I have been engaged in dredging contracts for many years, and as general manager of the Florida Dredging Company made a contract with Mr. Goodyear to put a hydraulic dredge on the bar in the fall of 1896, and continue it there for such time as was necessary to aid as an auxiliary in procuring the depths and widths contemplated by the river and harbor act under which Mr. Goodyear was working. I was deeply prejudiced against his methods, due to my education as a dredging contractor. In the fall of 1896 no dredging, in the sense in which dredging is usually understood, was done. I furnished a vessel with two 12-inch hydraulic pumps, which removed the material from the bottom into the top current—the sole reliance for its removal being upon the currents, in strict conformity with Mr. Goodyear's theory that the current was the best carrier of material. Used in this manner these pumps were not the only method used in 1896, but dynamite was exploded by Mr. Goodyear at critical points in the channel.

In the fall of 1897, due to earnest pressure upon the part of others interested and parties who had advanced money to the enterprise, I placed pockets for the first time in this dredge, and a portion of the time that fall material was removed from the bar by the usual process of pumping it into pockets and carrying it some distance from the bar; but a considerable portion of the time the pockets were not used, and the expedient adopted the preceding year of pouring the material into the top currents, relying upon the currents to carry it away, was applied. In spite of my preconceived prejudices against the methods adopted by Mr. Goodyear, investigation of his work from 1891 to 1896 developed that without the aid of a dredge of any character, for the first three years without the aid of any auxiliary machine of any character, he had procured a channel across the bar in use by the commerce of the port of 5 feet greater navigable depth than existed when he began work, and that at the point where the channel crossed the bar the depth had been increased 8 feet, or 1 and $\frac{2}{3}$ this feet average per year gain, in a far straighter channel than the old and abandoned channel. For the two years 1896-'97 when the dredge was used in the method stated, the total increase in depth, as shown by the survey of H. L. Marindin, officer of Coast and Geodetic Survey, was but one foot, or a half a foot a year. During the present year no dredge has been used upon this bar at all, Mr. Goodyear's sole reliance being upon dynamite, which he has exploded, and an auxiliary machine dragged by a tug for the purpose of stirring the bottom and aiding the movement of material by the currents.

The surveys of this bar which I have examined show that the deep-water pockets or contours from the sea inward and from the gorge between the islands outward have steadily been approaching each other during the entire progress of Goodyear's work. He has called for a survey for the 25 feet depth, 100 feet wide, and the 24 feet depth, 200 feet wide, entitling him to \$90,000 additional compensation, and that survey is now progressing. Its results can only be determined when the survey is completed, but it is the uniform opinion of seafaring men—pilots, towboatmen, and others—that the increased depth obtained by Mr. Goodyear this fall will result in a favorable survey. Mr. Goodyear's theory has been to break down the bar at and in the vicinity of the channel to attract the deep-water pockets or contours inside and out towards each other to induce a larger portion each year of the vast volume of water pouring from the gorge between the islands on each ebb tide to go channelward, thereby weakening the swash currents, by which large volumes of this water have poured out on the ebb tide over the shoals northward and southward, and before this work began was largely dissipated over shoals of several miles in width. His theory has been justified by surveys. The deep-water pockets have attracted nearer and nearer to each other over the entire extent of surveys which have been made during the progress of the work. The cross sections of the channel and of the bar on each side of it for long distances from the channel show marked deepening at all points, the greatest deepening being in the channel created by him and in use by commerce.

The removal of material from this bar in the channel and in its vicinity, north and south of it, has all tended toward the result he sought to obtain, namely, the inducing of a larger volume, and therefore a greater velocity, of water through this channel, which has been steadily in use by the commerce of the port, and year by year deeper-draft vessels cross this bar. There has been no shoaling, but on the contrary, whenever Mr. Goodyear has worked, a marked increase of depth, and the commerce of the port by the statistics has more than doubled in five years, and the vessels each year are of greater draft and tonnage than for the year preceding. The volume of material which has been removed from this bar during the progress of

Mr. Goodyear's work can not fall far short of 2,000,000 cubic yards, but a small fraction of which has been removed by the ordinary process of dredging in 1897. With all my preconceived prejudices against this work I have been compelled to recognize it as a marvelous and unique piece of engineering, with results, considering the amount appropriated by the Government, unprecedented in the history of outer-bar deepening, and the outlay by Mr. Goodyear far exceeding any money he has received from the Government.

With my knowledge of dredging upon ocean bars I do not hesitate to say that no dredging contractor would have undertaken to procure this water by the ordinary process of dredging, guaranteeing depths and widths, as Mr. Goodyear does under the "no cure, no pay plan," for anything like the sum the Government has conditionally appropriated for this purpose. The price of 15 cents per cubic yard for dredging upon the ocean bar of Brunswick, under the conditions which prevail upon that bar, would involve any contractor in heavy loss who undertook it. The conditions at Pensacola, Florida, and Brunswick, Georgia, are different. The distance from land and the weather conditions at Brunswick are such as to require a large price per cubic yard to save a contractor from loss. The comparison of dredging at Pensacola and at Brunswick by Rittenhouse Moore is singularly unfortunate, as he has had a number of contracts on that bar, ranging from 79 cents a cubic yard to the 15 cents he states he is now working for, several hundred thousand dollars having been spent for dredging at Pensacola, which has failed to maintain any increased depth thus obtained.

J. A. BRYAN, *Contractor,*
P. O. Address, Jacksonville, Florida.

APPENDIX No. 4.

ESTIMATES.

South jetty (built to mean low water).

Mattresses, 310,000 square yards, at 50 cents.....	\$155,000
Stone, 454,266 cubic yards, at \$3.....	1,362,798
Total.....	1,517,798

North jetty (built to mean low water).

Mattresses, 270,000 square yards, at 50 cents.....	\$135,000
Stone, 392,270 cubic yards, at \$3.....	1,176,810
Total.....	1,311,810

Curved breakwater (built to mean high water).

Mattresses, 139,555 square yards, at 50 cents.....	\$69,778
Stone, 588,000 cubic yards, at \$3.....	1,764,000
Total.....	1,833,778

Spur jetty on line A-M (built to mean low water).

Mattresses, 200,000 square yards, at 50 cents.....	\$100,000
Stone, 400,000 cubic yards, at \$3.....	1,200,000
Total.....	1,300,000

APPENDIX No. 5.

REPORT OF MR. JAMES H. BACON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Fernandina, Fla., October 14, 1900.

CAPTAIN: I have the honor to send you herewith, in separate packages, the maps, notebooks, and samples of borings pertaining to the recent survey of Brunswick outer bar, Georgia.

In making the detailed survey of the channel across the outer bar I found it impracticable to use, for transit work, the "inner station" and "outer station" established by the United States Coast and Geodetic Survey, owing to their unstable condition. For this work two stations on shore were used as transit stations, and protractors from each station were constructed on the map submitted.

Two tide gauges were simultaneously observed throughout the survey, one at Ocean Pier, St. Simons Island, and one at outer station till August 8, when this station was destroyed through some unknown agency. From August 8 to the end of the survey a gauge at inner station was observed. The mean low water established by the United States Coast and Geodetic Survey at these gauges was used. The soundings were reduced from the readings at these gauges. The area covered was divided into four sections. The soundings in section 1 were reduced from the actual readings at Ocean Pier, and those in section 4 from the readings at outer station. Those in sections 2 and 3 were reduced by making a proper allowance for the slope, as shown by simultaneous readings at the two gauges; thus, if the readings showed that the height of the tide above mean low water at Ocean Pier was 6 feet, and at the same time 6.6 feet at outer station, it was assumed that it was 6.2 feet in section 2 and 6.4 feet in section 3.

The borings were made with a force pump, using two sizes of pipe, one inside the other. The samples were forced up between the two pipes and were preserved whenever it was thought necessary. The borings develop the fact that the outer bar is composed of sand and shell overlying marsh mud. As a general rule the marsh mud appears at the elevation of about 20 feet below mean low water and extends an unknown distance below that level. Above this is either sand, or sand and mud, or sand and shell, or, in places, fine flat shell with very little sand. Nothing resembling clay was found, although in some cases the mud was very sticky and, after being churned up in a suction pump, might assume the appearance of clay. No material was found that could not be economically removed by a suction dredge.

The range of tide on the bar being 6.6 feet, a mean low-water depth of 18.4 feet equals the mean high-water depth to which the channel across the bar was dredged by Mr. C. P. Goodyear. An examination of the large chart shows that the shoaling above this depth in the channel has not been excessive. The channel dredged by Mr. Goodyear was not straight, but followed the line of buoys, as shown on the maps.

* * * * *

Very respectfully,

JAMES H. BACON,
Assistant Engineer.

Capt. CASSIUS E. GILLETTE,
Corps of Engineers, U. S. A.

N 15.

EXAMINATION AND PLAN AND ESTIMATE OF COST OF IMPROVING SAVANNAH HARBOR, GEORGIA.

[Printed in House Doc. No. 123, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 1, 1900.

SIR: I have the honor to submit herewith copy of report dated September 27, 1900, by Capt. C. E. Gillette, Corps of Engineers, upon preliminary examination of Savannah Harbor, Georgia, with a view to a reexamination of the plan for deepening said harbor as submitted in the Annual Report of the Chief of Engineers for 1888, page 1059, and a report as to what changes or modifications, if any, are necessary to carry out said plan, made to comply with requirements of the emergency river and harbor act of June 6, 1900.

In the opinion of the local officer, a further examination as to the feasibility and cost of providing additional improvement would be justified, and the duty of preparing a plan and estimate of cost of improvement was assigned by authority of the Secretary of War to a Board of Engineers. A copy of the Board's report on the subject, dated November 21, 1900, is herewith.

The plan presented by the Board contemplates improvement via the North Channel, by dredging and repairs to training walls, with a view to obtaining a navigable depth of 28 feet at mean high water from the old waterworks to the ocean, with widths varying from 350 feet to 500 feet, as indicated; also the construction of mooring basins at the Bight and Venus Point. The estimated cost of the work proposed is \$1,567,791, of which \$500,000 is now available, provided its expenditure in connection with the 28-foot project be authorized.

The Board considers that the large commercial interests involved justify the Government in providing a navigable depth of 28 feet at mean high water in this harbor.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

PRELIMINARY EXAMINATION OF SAVANNAH HARBOR, GEORGIA, WITH A
VIEW TO SECURING A DEPTH OF 28 FEET AT MEAN HIGH WATER.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., September 27, 1900.

GENERAL: In compliance with your letter of June 13, 1900, I have the honor to submit the following report of a preliminary examination directed by act of Congress of June 6, 1900, of the following locality:

Savannah Harbor: With a view to a reexamination of the plan for deepening said harbor, as submitted in the Report of the Chief of Engineers for eighteen hundred and ninety-eight, page ten hundred and fifty-nine, and a report as to what changes or modifications, if any, are necessary to carry out said plans.

The present project for the improvement of this harbor calls for a depth of 26 feet at mean high water, corresponding to a depth of 19½ feet at mean low water. The project mentioned above is for a depth 2 feet greater.

The commerce of Savannah is very large, and is increasing. The principal articles of freight depending upon water transportation are cotton, lumber, and naval stores. Roughly, the amount of the principal annual exports are as follows:

Cotton	bales..	1,250,000
Rosin	barrels..	1,000,000
Turpentine.....	do.....	325,000
Lumber	feet B. M.	170,000,000
Phosphate rock	tons.....	100,000
Pig iron	do.....	50,000
Cotton-seed oil	barrels..	135,000
Cotton-seed meal	sacks....	235,000
Cotton seed.....	do.....	135,000
Canned goods.....	boxes....	45,000
Cotton goods.....	cases....	70,000

Of these, the most reliable facts available indicate that the cotton shipments will increase for a number of years, after which it may possibly decrease, but such decrease will be due to the fact that mills in the territory tributary to Savannah will manufacture the cotton into fabrics, the shipment of which should largely replace cotton shipments. The shipments of naval stores, it is generally understood, may be expected to decrease, but although the sources of supply are constantly getting further from Savannah, the shipments have not yet begun to decrease, and while the amounts purchased and shipped by Savannah dealers may decrease, there are good grounds for believing that the total shipments through Savannah, by dealers in Savannah and dealers in other ports, will not decrease for ten or fifteen years to come. Shipments of lumber may be expected to very largely increase. While the total amount of available timber in Georgia is decreasing, the amount remaining is very large, and while the decrease may be expected to increase the price, that very fact will make it practicable to ship vastly larger quantities by rail to Savannah, and by boat to the markets. The other articles may be expected to largely increase.

There is a vast area of practically uncultivated ground in the territory tributary to Savannah which will be cultivated in cotton or other products whenever the market justifies it. Among these may be mentioned sugar cane and various starch-producing plants which grow luxuriantly in this section with a comparatively small amount of fertilization. Large shipments of iron products from the Alabama fields, and of wheat and corn from farther west, are within the limits of reasonable possibility. The rapid influx of cotton mills into Georgia now going on will bring an increase in population, farm products, etc., which may be expected to cause an increase in the water traffic through Savannah Harbor of all kinds of manufactured articles.

The navigable depth at present available in this harbor is utilized to its fullest extent by shipping. Ships now come to this port which can not load to their full draft at the wharves, but are forced to drop down half way to the bar to finish their cargo with the assistance of lighters. The established lines of coastwise steamers to Baltimore, Philadelphia, New York, and Boston are limited in their sailing hours to high tide. At present, railroad lines radiate from Savannah in five different directions, belonging to three independent trunk lines, all of which have recently made very extensive and costly improvements in their terminal facilities at this port.

From these facts it would appear that the present and prospective commercial importance of this port justifies an examination as to the feasibility and cost of providing the additional depth mentioned in the project of 1888, and it is, therefore, to the extent of such consideration, recommended to be worthy of improvement by the United States.

Very respectfully,

CASSIUS E. GILLETTE,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., September 29, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

The district engineer reports Savannah Harbor worthy of improvement by the General Government, and I concur in that opinion.

He also reports that an examination is justified, but does not give an estimate of the cost of such a survey as is contemplated in section 2 of the act of June 6, 1900. On August 31, 1900, there were \$488,545.06 for improving Savannah Harbor, and a portion of these funds is available for making the survey. Perhaps, however, no additional surveys are needed, but the district engineer does not so state in this preliminary examination.

It is recommended that Captain Gillette be requested to report the cost of a survey provided there are not sufficient data in his office to "report as to what changes or modifications, if any, are necessary to carry out said plans."

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 3, 1900.

Respectfully submitted to the Secretary of War.

In compliance with the terms of the emergency river and harbor act approved June 6, 1900, the within preliminary report is submitted on reexamination of Savannah Harbor, Georgia (full text of item quoted within).

In view of the present and prospective commercial importance of this port Captain Gillette states that a further examination as to the feasibility and cost of providing additional improvement would appear to be justified. Concurring in this view I have to recommend that preparation of plan and estimate of cost of improvement proposed be authorized and the subject committed to a Board of Engineers to be convened by orders from this office, the expense to be paid from appropriation for improving harbor at Savannah.

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

[Third indorsement.]

WAR DEPARTMENT,
October 3, 1900.

Approved as recommended by the Chief of Engineers.

G. D. MEIKLEJOHN,
Acting Secretary of War.

PLAN AND ESTIMATE OF COST OF IMPROVEMENT OF SAVANNAH HARBOR, GEORGIA, WITH A VIEW TO SECURING A DEPTH OF 28 FEET AT MEAN HIGH WATER.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., November 21, 1900.

GENERAL: The Board of Engineer Officers, constituted by Special Orders, No. 46, Headquarters, Corps of Engineers, Washington, October 5, 1900, to revise the project of improvement for Savannah Harbor, Georgia, has the honor to submit the following report.

The act of Congress approved June 6, 1900, provides as follows:

SEC. 2. That the Secretary of War is hereby authorized to cause preliminary examinations and surveys to be made at the localities named in this section, as hereinafter provided. * * *

Savannah Harbor [Georgia]: With a view to a reexamination of the plan for deepening said harbor, as submitted in the Report of the Chief of Engineers for eighteen hundred and eighty-eight, page ten hundred and fifty-nine, and a report as to what changes or modifications, if any, are necessary to carry out said plan.

The preliminary examination having been made by the local engineer with a recommendation that the harbor was worthy of improvement by the United States to the extent of the reexamination provided in the act, the Board was charged by the above order with the duty of examining and reporting "as to what changes or modifications, if any, are necessary to carry out the plans for deepening Savannah Harbor, Georgia," as given in the above-quoted act of Congress.

Other important duties of the members of the Board preventing an earlier meeting, the Board met at Savannah, Ga., at 10 a. m., on November 5 and 6, 1900, and after giving careful consideration to the complete survey of the harbor recently made and the tabular statement of the results of this survey prepared by the local engineer, and making an examination of the work previously done, the Board adjourned, to reconvene in Baltimore on November 21, 1900, upon which date the Board met at 1 p. m., and, after further consideration and discussion of the subject, submits the following statement, recommendation, and estimate.

The project to be reexamined is dated October 12, 1887, and is printed in the Report of the Chief of Engineers for 1888, beginning at page 1059. It provided for a navigable depth of 28 feet between the upper limit of the city of Savannah and the sea, the work to be accomplished by training walls from above the city to Tybee Roads, by converging jetties between Tybee Roads and the outer slope of the ocean bar, and by extensive dredging from the city to the ocean. The widening of the river at points above, as auxiliary to the tidal flow, was also provided for. The proposed localities of the training walls and jetties are given on a map accompanying the report.

The total distance from the upper end of the proposed channel (which was at the upper limits of the city, at the old waterworks) to deep water outside the bar is about 25 miles; but only portions of this distance, aggregating about $15\frac{1}{2}$ miles, needed increase in depth.

The project provided for a width of 300 feet of channel through the shoals, there being of course a greater width in the deep pockets between the shoals. This project was never adopted.

In 1890 a project providing for a depth of 26 feet at mean high water, but with a greater width than was provided for in the above project, viz, 300 feet from the old waterworks to the upper end of the

South Channel, and 400 feet from that point to the ocean, was adopted on July 22, 1890. It is to be found in the Report of the Chief of Engineers for 1890, beginning on page 1259. From July 22, 1890, to July 31, 1896, work was carried on under this project, there being expended \$3,495,532.61.

This work resulted in giving the project depth of 26 feet from the Ocean Steamship Company's wharves to the sea, but fell short of completing the project, the channel width being only a little over two-thirds of the project requirements. Neither the width nor the depth required were obtained at the upper end of the improvement, between the Ocean Steamship Company's wharves and the old waterworks, a distance of about half a mile, and the river at some of the congested points opposite the city and above was not widened, as called for in the project.

This project and the work done under it were in line with the 28-foot project under consideration, the training walls having about the same location under the two projects. Both projects provided for training walls raised to low-water mark, but while constructed to that height they have materially failed to maintain it in places. In connection with this work about 6,000,000 cubic yards of material were dredged from the channel.

Under date of December 13, 1894, a modified project was submitted, providing for the construction of a portion of the jetty work north of Tybee Roads, indicated in the 28-foot project under consideration. This modified project is found printed in the Report of the Chief of Engineers for 1895, page 1459.

Congress, by the act of June 3, 1896, adopted this project and appropriated \$1,005,000 for its execution, including extensive dredging in Savannah Harbor and a small amount of dredging and jetty work for the improvement of the inside route to Beaufort, partially in this harbor.

Under this project about 1,000,000 cubic yards of dredging has been done in the harbor; also considerable work on the training wall north of Tybee Roads. The contract with the Atlantic Contracting Company for the construction of this training wall was annulled on October 3, 1899, since which date no work under the project has been done except dredging. There is at present available a balance of about \$500,000.

A complete survey of the harbor was made in 1894, subsequent to the completion of nearly all of the training walls, and another in 1900. These two surveys have been compared, and they indicate that in that time, making due allowance for dredging, natural forces have scoured from the regulated channel between the training walls about 1,000,000 cubic yards of material. This material has apparently not been deposited in Tybee Roads. Outside of the regulated channel, behind training walls, etc., during the same period, there has been deposited something over 2,000,000 cubic yards of material. This is mostly very fine, and its amount is to be accounted for by the material that has disappeared from between the training walls, by nearly 500,000 yards which has been scoured out of the river bed for some distance above the regulated channel, and by material brought down from the upper river in suspension.

The scour in the regulated area has been principally near the axis of the channel, and has amounted to an average of nearly 1 foot in depth

over the length of that channel. It has probably been accompanied by a sorting process by which the heavier and coarser particles have remained in the channel and the finer mud deposited behind the training walls, lower down the river.

The quantity that has been brought down by the river is indeterminate, since the great area concerned prevents its accurate determination.

The theory upon which the present training walls were constructed is that the material scoured out from between them by their successful operation would be carried to sea; but it apparently overlooks the fact that the ends of the training walls or jetties are not in the sea, but in Tybee Roads, a basin of shoal water inside the bar, and the scour of the large mass of material from the regulated channel might be expected to be deposited in the roads and, by causing shoals, be very troublesome to provide for. The Board considers this a real danger, although the material scoured out during the past six years has not, apparently, been deposited in Tybee Roads.

The construction of the training walls has considerably interfered with the tidal range, the tide neither rising so high nor falling so low in the upper portion of the harbor as it did before the works were constructed.

For these reasons the Board recommends the removal of material from the channel by dredging, and does not recommend the raising of the training walls to low water until after a large portion of the dredging has been done and the tidal volume thereby increased.

During the past ten years the channel across the bar has been moving gradually to the southward and increasing in depth, there being at least a foot more water there now than there was ten years ago. This bar is probably the least subject to change of any on the South Atlantic coast, and a moderate deepening of the channel can be made and maintained by dredging at a very much less cost than by the construction of jetties, which would be very long, very expensive, and also certain to interfere with the tidal regimen of the harbor.

RECOMMENDATIONS.

After giving the subject careful consideration, the Board considers that the large commercial interests involved justify the Government in providing a navigable depth in this harbor of 28 feet at mean high water from the old waterworks to the ocean. For the proper accommodation of shipping this channel should have a bottom width of 400 feet from its upper end down to the lower city limits, and, to assist in the maintenance of this, the same width should be continued down to Fort Oglethorpe. Below that point the Board recommends a channel of the same depth, with a bottom width of 350 feet in the straight portions and from 450 to 500 feet in the bends, according to the sharpness of the curves. The channel from Oyster Bed to Tybee Roads, and the channel across the bar, should each have a width of 500 feet.

In estimating the quantities of material to be removed to produce the above depth of 28 feet at mean high water, due allowances are made for variation in the mean tidal rise at different points, for probable filling from the sides, and for extra depth required on the bar on account of the ocean swell, which include all the probable contingencies of dredging work.

The Board recommends the ultimate raising of all existing training walls between the city and Tybee Roads to mean low water, the time of doing this work to be determined by the local engineer. It is not recommended that any jetties be built for the improvement of the bar, or that any further work be done on the training wall north of Tybee Roads.

The dredging between the old waterworks and the Oyster Bed should be done by contract or by Government dredges, and most of the material either dumped upon marsh lands or behind training walls.

In the estimate allowance is made for the handling of the material dredged in dump scows and subsequently pumping it on shore or behind training walls, the condition of the river not providing adequate facilities for dumping directly more than a small proportion of the material to be removed. The estimated cost of this dredging, at 15 cents per cubic yard, is \$956,700.

The dredging below the Oyster Bed (across Tybee Knoll and on the ocean bar) should be done by a dredge owned and operated by the Government, on account of the fact that, since the Government is the only patron of ocean-bar dredging, competition for the work could hardly be expected, and the contingencies of such work being large and the outlay required to provide suitable dredges being quite heavy, the doing of such work by contract could only result in excessive cost to the Government. This work is estimated at 13 cents per cubic yard, and amounts to \$520,260.

The total cost of the improvement recommended, including dredging and the raising of the training walls, is \$1,539,135, of which, as stated above, \$500,000 is now available, provided its expenditure in connection with the 28-foot project be authorized.

Under present conditions the larger vessels generally take two tides to get to sea from Savannah, on account of the long distance to be traversed. They anchor generally at the Bight or Venus Point. This interferes to some extent with passing ships, and it would be a great advantage to shipping to be able to tie up at these points instead of anchoring.

The same thing may be expected after the proposed increase in depth. Ships will still be loaded to the full capacity of the harbor and require two tides to make the bar. To provide for this the Board recommends the construction of mooring dolphins, with the necessary dredging to provide a basin about 1,500 feet long at the Bight and another 3,000 feet long at Venus Point.

ESTIMATE.

In this estimate all depths mentioned are referred to mean low water.

Dredging.

	Cubic yards.
Marsh Island Channel, 400 feet wide, 22 feet deep	1,000,000
City front, 400 feet wide, 22 feet deep	1,161,000
Wrecks Channel, 400 feet wide, 22 feet deep	940,000
Obstructions Channel, 350 feet wide (increasing to 450 feet in lower half), 22 feet deep	429,000
Upper and Lower Flats, 350 feet wide (450 to 500 feet at turns), 22 feet deep ..	1,300,000
Long Island Crossing, 350 feet wide (475 feet at turns), 22 feet deep	1,548,000
Total, above Oyster Bed	6,378,000
At 15 cents per cubic yard, \$956,700.	

	Cubic yards.
Oyster Bed to Tybee Roads, 500 feet wide, 22 feet deep	2, 252, 000
Outer Bar, 500 feet wide, 23 feet deep.....	1, 750, 000
Total sea dredging.....	4, 002, 000
At 13 cents per cubic yard, \$520,260.	

Repairs to training walls.

(1) Marsh Island training wall:		
1,500 cubic yards of brush bundles, at 50 cents per cubic yard...	\$750	
100 cubic yards of stone, at \$2.75 per cubic yard	275	
		\$1, 025
(2) Garden Bank training wall:		
1,000 cubic yards of brush bundles, at 50 cents per cubic yard...	500	
100 cubic yards of stone, at \$2.75 per cubic yard	275	
		775
(3) Mackay Point training wall:		
5,000 cubic yards of brush bundles, at 50 cents per cubic yard...	2, 500	
1,000 cubic yards of stone, at \$2.75 per cubic yard	2, 750	
		5, 250
(4) Barnwell Island training wall:		
3,000 cubic yards of brush bundles, at 50 cents per cubic yard...	1, 500	
200 cubic yards of stone, at \$2.75 per cubic yard	550	
		2, 050
(5) North Elba Island training wall:		
6,000 cubic yards of brush bundles, at 50 cents per cubic yard...	3, 000	
500 cubic yards of stone, at \$2.75 per cubic yard	1, 375	
		4, 375
(6) South Elba Island training wall:		
2,000 cubic yards of brush bundles, at 50 cents per cubic yard..	1, 000	
200 cubic yards of stone, at \$2.75 per cubic yard.....	550	
		1, 550
(7) Venus Point training wall:		
3,000 cubic yards of brush bundles, at 50 cents per cubic yard..	1, 500	
600 cubic yards of stone, at \$2.75 per cubic yard.....	1, 650	
		3, 150
(8) North Long Island training wall:		
2,000 cubic yards of stone, at \$2.75 per cubic yard	5, 500	
(9) Cocks spur Island training wall:		
7,000 cubic yards of stone, at \$2.75 per cubic yard	19, 250	
(10) Oyster Bed training wall:		
7,000 cubic yards of stone, at \$2.75 per cubic yard	19, 250	
Total repairs to training walls		62, 175

Mooring basins.

Total dredging, 31,000 cubic yards, at 15 cents per cubic yard	\$4, 650
Pile work.....	24, 006
Total for mooring basins	28, 656

Summary.

Dredging	\$1, 476, 960
Jetty work.....	62, 175
Mooring basins.....	28, 656
Total	1, 567, 791

REMARKS.

The Board has given consideration to the subject of the removal of Cross-Tides Dam and also to the question of the substitution of the South Channel for the North Channel as a part of the route to the sea.

Concerning the Cross-Tides Dam, the present survey shows that the

extensive use of Back River as a dumping ground, together with the construction of Cross-Tides Dam, has caused this channel to shoal very extensively, and it is feared that the removal of this dam would tend to scour large quantities of this material back into the navigable channel below. The crest of the dam is now at an average of about a foot below mean low water. The Board therefore considers it inadvisable to disturb the present conditions due to the existence of this dam.

The adoption of a route via the South Channel, including the removal of Cross-Tides Dam and the replacing of it with a dam above the head of deep water in the channel past the city, together with the total separation of North Channel and South Channel by the extension of the Fig Island jetty to the head of Elba Island, would have certain advantages, in that it would leave the North Channel-Back River waterway a natural stream for the reception of sediment brought down from the upper river and leave the South Channel-Front River waterway in the nature of an independent arm of the sea, free from deposits of the river sediment, except the small quantities brought down in suspension.

The Board finds that to carry out the jetty work and the removal of the present jetty work called for would cost about \$800,000. The dredging in South Channel, at 10 cents per cubic yard, would cost about \$1,400,000. The dredging on the outer bar and above the head of South Channel, as given in the above estimate, would amount to about \$680,000, making a total cost of about \$2,880,000, and showing that under present conditions the North Channel is the more advantageous route for improvement.

Respectfully submitted.

PETER C. HAINS,
Colonel, Corps of Engineers.

J. C. SANFORD,
Captain, Corps of Engineers.

CASSIUS E. GILLETTE,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

N 16.

PRELIMINARY EXAMINATION OF SKIDDAWAY NARROWS, GEORGIA.

[Printed in House Doc. No. 91, Fifty-sixth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS.

UNITED STATES ARMY,
Washington, November 20, 1900.

SIR: I have the honor to submit herewith for transmission to Congress copy of report, dated September 26, 1900, by Capt. Cassius E. Gillette, Corps of Engineers, upon preliminary examination of Skid-

daway Narrows, Georgia, authorized by the emergency river and harbor act approved June 6, 1900, as follows:

Skiddaway Narrows: Preliminary examination and survey of the Skiddaway Narrows, connecting the Isle of Hope River with Burnside River, for a channel seventy-five feet wide and six feet deep at mean low water.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF CAPT. CASSIUS E. GILLETTE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., September 26, 1900.

GENERAL: In compliance with your letter of June 13, 1900, I have the honor to submit the following report of a preliminary examination of the following locality, as specified in the act of Congress, approved June 6, 1900, viz:

Skiddaway Narrows: Preliminary examination and survey of the Skiddaway Narrows, connecting the Isle of Hope River with Burnside River, for a channel seventy-five feet wide and six feet deep at mean low water.

The present navigable route through Skiddaway Narrows consists of an extremely tortuous and very narrow channel, the bottom of which is bare at low water and at high water an ordinary row boat can not pass through the channel without the oars being interfered with on both sides from the marsh grass growing on the banks.

Nevertheless, a great deal of commerce passes over this route. It consists mostly of rice, oysters, and other commodities, carried in small sailing vessels. This is a part of the commerce which follows what is known as the Inside Waterway between Savannah, Ga., and Fernandina, Fla. Beyond this there is little or no local commerce, and the route would be of no special local value except for pleasure boats and a few residents in the immediate vicinity. The through commerce is, or can be, provided for by other and better routes. The local commerce is too small to justify a cut through the Narrows, which would be nearly 2 miles long.

It is therefore recommended that Skiddaway Narrows is not worthy of improvement by the United States.

Very respectfully,

CASSIUS E. GILLETTE,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., September 28, 1900.

Respectfully submitted to the Chief of Engineers, United States Army.

In view of the fact, as stated by the district engineer, that the local commerce is too small to justify the United States in making a cut

through Skiddaway Narrows, and inasmuch as better routes exist for the accommodation of through commerce, I am of the opinion that the cutting of "a channel 75 feet wide and 6 feet deep at mean low water," connecting the Isle of Hope with Burnside River, is not worthy of improvement by the General Government.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 24, 1900.

Respectfully submitted to the Secretary of War, concurring in the opinion of the local officer and of the division engineer that improvement of the locality by the General Government, in the manner indicated by the act authorizing the examination, is not advisable.

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

[Third indorsement.]

WAR DEPARTMENT,
October 27, 1900.

The views of the local officer and of the division engineer, as concurred in by the Chief of Engineers, are approved.

ELIHU ROOT,
Secretary of War.

N 17.

EXTENSION OF HARBOR LINES IN SAVANNAH RIVER AT SAVANNAH, GEORGIA.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., June 26, 1900.

GENERAL: The harbor lines in the harbor of Savannah extend up as far as the old waterworks. At the time they were laid out the lines were carried some distance farther on the maps, but the Board which met in 1889 only recommended for approval to the waterworks. Since then the construction of the Georgia and Alabama Railway Bridge across the river and other causes are inducing commercial development in that part of the harbor, and several applications for permits to build wharves, pile timber booms, etc., will doubtless be made. It will save a great deal of trouble if the harbor lines can be adopted now, and it is recommended that the dotted lines on the inclosed map,¹ marked "proposed extension of harbor lines," be approved as harbor lines by the Secretary of War.

Very respectfully,

CASSIUS E. GILLETTE,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

¹Not printed.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 30, 1900.

Respectfully referred to Col. Peter C. Hains, Corps of Engineers, Division Engineer, Southeast Division, for his views and recommendation.

To be returned.

By command of Brigadier-General WILSON:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[Second indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., July 6, 1900.

Respectfully submitted to the Chief of Engineers, U. S. A.

I concur with the views of the district engineer in regard to the necessity of extending the harbor lines in front of the city of Savannah farther upstream.

The rapid developments of trade and improvements along the city front make this necessary.

The lines suggested by the district engineer seem to be such as to meet the requirements, and I recommend that they be approved.

PETER C. HAINS,
*Colonel, Corps of Engineers,
Division Engineer, Southeast Division.*

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 14, 1900.

Respectfully submitted to the Secretary of War.

The harbor lines for Savannah Harbor approved by the Secretary of War May 4, 1889, extended up the Savannah River to a point known as the "old waterworks."

The present and prospective commercial development of the locality makes it desirable to extend the line farther up the river, and the district engineer officer has submitted the accompanying tracing on which the desired extension is indicated by broken black lines.

I recommend that the extension be approved, and that the Secretary place his approval on the tracing, which has been prepared for his signature.

A. MACKENZIE,
Acting Chief of Engineers.

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of July 17, 1900, the approval being indicated on the map.

APPENDIX O.

IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF FLORIDA, AND OF HARBOR AT KEY WEST, FLORIDA, AND ENTRANCE THERETO.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1901, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, CAPT. C. H. MCKINSTRY AND CAPT. THOS. H. REES, CORPS OF ENGINEERS.

IMPROVEMENTS.

- | | |
|--|---|
| 1. St. Johns River, Florida. | 7. Key West Harbor, Florida, and entrance thereto. |
| 2. St. Johns River, Orange Mills Flats, Florida. | 8. Removing the water hyacinth from Florida waters. |
| 3. Volusia Bar, Florida. | 9. Dredge for river and harbor improvements, Florida. |
| 4. Ocklawaha River, Florida. | |
| 5. St. Augustine Harbor, Florida. | |
| 6. Indian River, Florida. | |
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UNITED STATES ENGINEER OFFICE,
Tampa, Fla., July 18, 1901.

GENERAL: I have the honor to submit herewith * * * my annual reports for the fiscal year ending June 30, 1901, as follows:
* * * * *

Very respectfully, your obedient servant,

THOS. H. REES,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

O I.

IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to pages 1305 to 1312, Report of the Chief of Engineers for 1896, and to pages 1586 to 1604, Report of the Chief of Engineers for 1895, the latter being a report upon a survey of St. Johns River, Florida, from Jacksonville to the ocean, with a view of securing a 24-foot channel, and to pages 1327 to 1330, Report of the Chief of Engineers for 1898.

A survey of the river from the entrance to Dames Point was made April 22 to May 7, the map of which in three sheets is presented herewith.

IMPROVEMENT AT THE ENTRANCE.

Work under the contract with Roderick G. Ross, of Jacksonville, Fla., in force at the beginning of the fiscal year, is still in progress. This contract was entered into December 1, 1899. Work began March 2, 1900, and the contract will probably be finished within two or three months from the present time.

North jetty.—To June 30, 1900, the foundation and hearting of the north jetty was extended to station 12949, with a crest width of about 35 feet at an average depth of about 3 feet below mean low water to station 12200 and a crest width of about 50 feet at an average depth of 6 feet below mean low water, thence to the outer end. Between stations 3500 and 8611 the jetty has been built up to about 7 feet above mean low water with large stone. During the fiscal year ending June 30, 1901, 37,932.2 tons of first-class, 9,065.6 tons of second-class, and 9,759.1 tons of third-class stone was placed.

Excepting where work has been done during the year, the condition of the north jetty remains about as it was last year. From the inner end it slopes down to about mean low water at station 1250. This portion of the jetty is mostly covered with sand. From station 1250 to station 3500 the crest of the jetty averages about 2 feet below mean low water, with a depression at station 1800 to about 4 feet below mean low water, and another at station 2100 to about 6 feet below mean low water. From station 35 to station 8600 the crest of the jetty varies from 4 feet to 8 feet above mean low water, with occasional projections above 8 feet and a few depressions below 4 feet above mean low water. From station 8600 to 9400 the crest is at an average of 6 feet below mean low water. It then gradually rises in an irregular manner to an elevation of 8 feet above mean low water at station 10750. It then suddenly drops to about 1 foot below mean low water, at which reference it continues to station 12050, from which point it slopes downward to the outer end at station 12949, where it is 6 feet below mean low water.

South jetty.—There was no work done on the south jetty during the year. The profile accompanying the map of the annual survey shows greater irregularities than that of last year, but the average elevation of the crest appears to be about the same.

Depths.—The area bounded by the 6-foot contour on the large shoal contiguous to the north jetty from the shore out has decreased somewhat, and the western side of this shoal has assumed a much flatter slope. This may be taken as an indication that the movement of sand across the shoal toward the west is much less than heretofore if it has not ceased altogether. Under the protection of the high portion of the north jetty, which has been built up during the year, a channel appears to be forming close along the jetty of which there was very little, if any, trace last year.

The area of the cross section between the outer ends of the jetties remains about as last year, although some shoaling is noticeable in the deeper parts of the channel. The distance between the inner and outer 15-foot contours on the bar is 900 feet this year, as against 1,200 feet

last year. The available channel depth across the bar is now only about $12\frac{1}{2}$ feet at mean low water. This was reported to be 14.2 feet last year.

The salient formed by the bar has a more uniform contour than is shown on the map of last year. The locations of contours on the outer slope of the bar are about as last year, on a prolongation of the axis of the south jetty, but on the prolongation of the axis of the north jetty they have been pushed seaward about 200 feet.

Dredging on the bar.—The dredge *Cape Fear*, belonging to the Wilmington, N. C., district, being at work in the river above the mouth, instructions were issued September 17 to dredge on the ocean bar whenever the conditions were such that it could be done with safety. No dredging was done at this place until November 2. From that date until January 26 dredging was done on the bar at irregular intervals. A total of 16,425 cubic yards was removed from the bar. No trace of this work is apparent in the map of the last survey; in fact, the available depth is less than when the dredging began. This is a further illustration of the futility of attempting to dredge this bar until the north jetty has been extended and built high enough to afford protection to such operations and prevent the dredged channel from being obliterated by the action of the storm waves.

A dredge of greater capacity and less draft than the *Cape Fear* would be enabled to take advantage of calm weather and to work on all stages of the tide, and might in a short time provide a deep and well-defined channel, which would concentrate the flow of the current and give it a natural trend in the desired direction. This would enable the current to combat more successfully the deleterious effect of the waves and would doubtless give much better final results than those attained in this instance.

THE RIVER ABOVE THE MOUTH.

The U. S. dredge *Cape Fear*, belonging to the Wilmington, N. C., district, continued at work in the river with occasional work on the bar at the entrance until January 26. When the dredge began work on the river April 10, 1900, there were four shoal places in the channel where a deficiency in depth had been complained of, viz: Dames Point cut, Browns Creek cut, White Shells cut, and Mile Point cut. The shoal at White Shells cut was removed before the end of the fiscal year ending June 30, 1900, and a considerable amount of work had been done at each of the other places mentioned excepting Mile Point cut, at which place work only began June 25, 1900. During this year 28,136 cubic yards were removed from Dames Point cut, 3,543 cubic yards from Browns Creek cut, and 116,467 cubic yards from Mile Point cut, a total of 148,146 cubic yards, which, with the amount removed from these localities during the previous year, makes a total of 242,366 cubic yards removed by the dredge *Cape Fear* from the cuts in the river above the mouth.

The cuts were dredged to a depth of from 17 to 18 feet. An inspection of the maps of the survey made in May, which are presented herewith, shows the following depths: Dames Point cut has an excess of 18 feet, except at the upper end, where only about 17 feet is found, and at the lower end, where there is about $17\frac{1}{2}$ feet. Browns Creek cut has evidently deepened since dredged, as 19 feet is found throughout. White Shells cut has a depth in excess of 18 feet, excepting one small place near the middle of the cut where there is $17\frac{1}{2}$ feet,

and another place near the upper end where there is about 17½ feet. There is a least depth of 16½ feet in Mile Point cut, excepting one place near the upper end, where the dredged channel has shoaled to about 15 feet. The recent survey has also developed the fact that shoaling has occurred in St. Charles Creek cut. This was dredged in 1893 to a depth of 18 feet. Since that time no work has been done at this place. The recent survey shows that opposite the mouth of St. Charles Creek the depth is only 16½ feet. Elsewhere this cut is in good condition. The above depths all refer to the plane of mean low water. The mean range of tide varies from 5.22 feet at the bar to 1.8 feet at Dames Point.

As stated in the last annual report, in order to successfully complete this project within a reasonable time and within the estimated cost, it is necessary that the work be placed under the continuous contract system, or that more adequate appropriations be made. Five hundred thousand dollars could be profitably expended yearly until the project is completed.

To provide for the increasing needs of commerce and afford relief in the most economical and expeditious manner, it is recommended that provision be made for the early construction of a hydraulic dredge adapted for use in the river and on the bar. It is estimated that such a dredge will cost \$150,000.

Money statement.

July 1, 1900, balance unexpended	\$216,527. 03
June 30, 1901, amount expended during fiscal year	150,387. 65
July 1, 1901, balance unexpended	66,139. 38
July 1, 1901, outstanding liabilities	34,825. 98
July 1, 1901, balance available	31,313. 40
July 1, 1901, amount covered by uncompleted contracts	24,111. 31
{ Amount (estimated) required for completion of existing project	1,709,750. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	500,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS FOR IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

Under the original project the following appropriations were made for the work:

June 14, 1880	\$125,000
March 3, 1881	100,000
August 2, 1882	150,000
July 5, 1884	150,000
August 5, 1886	150,000
August 11, 1888	175,000
September 19, 1890	170,000
July 13, 1892	112,500
March 3, 1893	284,500
Total	\$1,417,000
Under the existing project of improvement the following appropriations have been made:	
June 3, 1896	\$200,000
March 3, 1899	200,000
	400,000
Aggregate	1,817,000

ST. JOHNS RIVER, FLORIDA.
FROM THE ENTRANCE TO DAMES POINT.

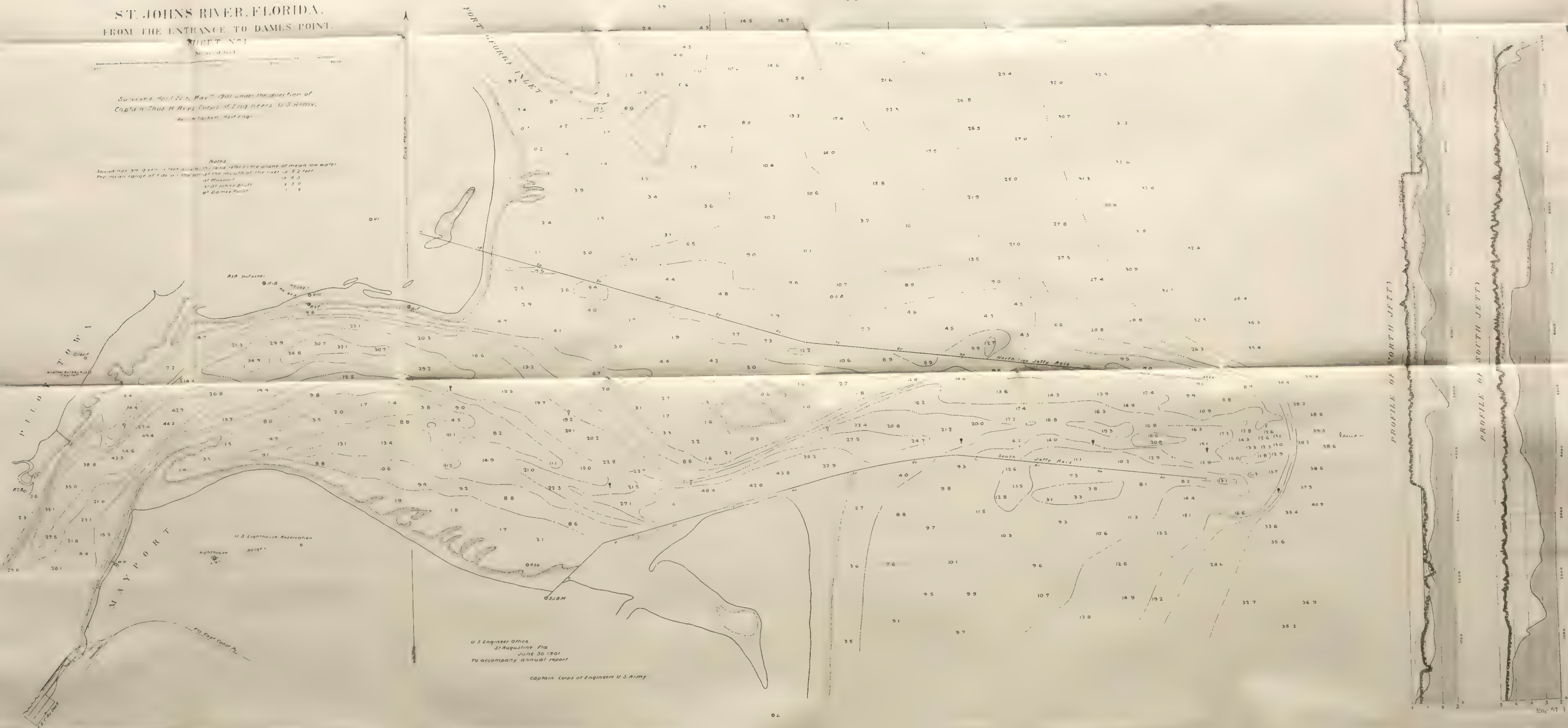
SHEET No. 1

Scale of feet

Surveyed April 24 to May 11, 1901 under the direction of
Captain Thos. H. Rens, Corps of Engineers, U. S. Army,
by W. S. Sackett, Assistant Engineer.

Notes

Soundings are given in feet above the plane of mean low water.
The mean range of tide at the mouth of the river is 5.2 feet.
at Mayport 14.9.3
at St. Johns Gulf 13.0
at Dames Point 11.8



PROFILE OF NORTH JETTY

PROFILE OF SOUTH JETTY

Contract in force during fiscal year.

Name of contractor.	Contract.	Dated.	Approved.	Date of beginning.	Date of expiration.
Roderick G. Ross	Jetty construction....	Dec. 1, 1899	Dec. 30, 1899	Mar. 2, 1900	Oct. 2, 1901
Quantities.					Price per ton.
About 49,000 tons first-class stone.....					\$2.33
About 20,000 tons second-class stone.....					2.33
About 20,000 tons third-class stone.....					2.00

COMMERCIAL STATISTICS.

Commerce of St. Johns River, Florida, during the year ending December 31, 1900.

[Furnished by Jacksonville Board of Trade.]

Articles.	Gross tonnage.	Value.
Cattle.....	125	\$11,617
Cotton.....	4,850	968,750
Fertilizers.....	3,363	111,905
Fruits.....	4,386	225,725
Grain.....	8,435	115,435
Cross-ties.....	42,240	166,950
Shingles.....	11,840	75,243
Lumber.....	262,208	1,897,938
Clay.....	51,772	46,540
Brick.....	210	686
Naval stores.....	31,742	2,229,126
Vegetables.....	11,377	148,022
Fish and oysters.....	844	67,525
Steel rails.....	11,611	278,032
Coal.....	48,162	207,359
Oil.....	1,330	398,838
Tobacco.....	45	45,000
Merchandise.....	148,044	15,034,355
Hay.....	301	4,285
Iron.....	6,336	154,935
Total.....	649,221	22,118,266

Arrivals and departures of vessels for the year ending December 31, 1900.

	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steam.....	227	360,157	234	358,807
Sailing.....	308	108,235	299	107,731
Yacht.....	1	237		
Total.....	536	468,629	533	466,538

Estimated number of passengers carried by water, 433,300.

Probable increase of trade were improvement completed, 100 per cent.

O 2.

IMPROVEMENT OF ST. JOHNS RIVER AT ORANGE MILLS FLATS, FLORIDA.

A preliminary examination of this locality was made under the direction of Lieut. Col. W. H. H. Benyaure, Corps of Engineers, May 19, 1898, and his report thereon, dated May 30, 1898, stating the

original condition of the locality and proposing a project for improvement, is printed on pages 1344 to 1348, Report of the Chief of Engineers for 1898.

With a portion of the appropriation of \$40,000 made for this work by the river and harbor act approved March 3, 1899, a survey from Tocoï Point to Cow Creek was made under the direction of Capt. C. H. McKinstry, Corps of Engineers, between July 10 and August 17, 1899. Captain McKinstry's report of this survey, dated December 26, 1899, together with three maps and report of assistant engineer, is printed in Report of the Chief of Engineers for 1900, pages 1972 et seq.

The approved project contemplates the formation of a channel 200 feet wide and 13 feet deep at mean low water through the shoals between Jacksonville and Palatka, Fla., at an estimated cost of \$120,000.

With the appropriation of \$40,000 made in act of March 3, 1899, a survey was made of the portions of the river requiring improvement within the limits named, and a contract was entered into with P. Sanford Ross, Incorporated, November 14, 1899, to dredge the channel across Orange Mills Flats proper at the rate of 9.7 cents per cubic yard. Dredging was begun under this contract April 2, 1900, and was completed October 5, 1900. Five beacons to mark the dredged channel were placed by the contractor between October 5 and 23. Up to the end of the fiscal year ending June 30, 1900, 160,426 cubic yards of material had been dredged. The total amount of material dredged within the limits specified in the contract was 343,148.7 cubic yards. In addition to this amount 7,198.5 cubic yards were removed in excess of the depth required. The channel dredged was 13,164 feet long. The lower portion, for a distance of 9,614 feet, was made 160 feet wide; the remaining upper portion, a distance of 3,550 feet, was made 120 feet wide.

The sum of \$65,000 could be profitably expended on this work during the fiscal year ending June 30, 1903.

Money statement.

July 1, 1900, balance unexpended	\$27, 349. 75
June 30, 1901, amount expended during fiscal year	27, 064. 22
July 1, 1901, balance unexpended	285. 53
{ Amount (estimated) required for completion of existing project.	80, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	65, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

Appropriation for improvement of St. Johns River, Orange Mills flats, March 3, 1899.....	\$40, 000
--	-----------

Contract in force during fiscal year.

Name of contractor.	Contract.	Dated.	Date approved.	Date of beginning.	Date of expiration.	Price per cubic yard.
P. Sanford Ross, Incorporated.	Dredging about 330,000 cubic yards soft material.	Nov. 14, 1899	Dec. 1, 1899	Feb. 4, 1900 (extended 90 days).	Dec. 4, 1900	\$0.097

COMMERCIAL STATISTICS.

Commerce of Orange Mills flats during the year ending December 31, 1900.

[Furnished by Wilson Cypress Company, Palatka, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Fertilizers.....	5, 000	Naval stores	2, 500
Lumber.....	150, 000	Sash, doors, and blinds.....	3, 000
Shingles.....	2, 000	Total.....	171, 500
Merchandise.....	9, 000		

A large amount of turpentine and resin is lightered to Jacksonville, owing to the difficulty in getting ships to the docks at Palatka. Large quantities of lumber also go either by rail or lighter to Jacksonville.

Arrivals and departures of vessels for the year ending December 31, 1900.

Clyde Line of steamers make daily trips in winter and twice a week in summer. Beach & Miller Line, daily trips; Lucas line, daily trips.

Probable increase of trade were improvement completed, 100 per cent.

O 3.

IMPROVEMENT OF VOLUSIA BAR, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to the Annual Report of the Chief of Engineers for 1897, page 1550, and for 1896, pages 1313 and 1314.

Since the appropriation of \$7,500 made in act approved August 5, 1886, the appropriations made for this improvement have been for maintenance and have been expended for that purpose.

During June and July, 1899, the two rows of fender piles were placed in good repair. Since that time no work has been done. A small amount of dredging and repairs to the fender piles are required from time to time for the maintenance of this improvement, and it is estimated that \$2,000 will be required each year to keep the bar in a navigable condition.

Money statement.

{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement unexpended July 1, 1901	\$2, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for improvement and maintenance of Volusia bar, Florida.

Act of—		Act of—	
June 14, 1880.....	\$5, 000	July 13, 1892.....	\$1, 000
March 3, 1881.....	5, 500	August 18, 1894.....	1, 000
August 2, 1882.....	5, 000	June 3, 1896.....	1, 000
July 5, 1884.....	2, 000	March 3, 1899.....	2, 000
August 5, 1886.....	7, 500		
August 11, 1888.....	500	Total	31, 000
September 19, 1890.....	500		

1740 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

COMMERCIAL STATISTICS.

Commerce of Volusia bar during year ending December 31, 1900.

[Furnished by Clyde St. Johns River Line.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cattle.....	141	Pineapples.....	82
Fertilizers.....	5,927	Ship stores.....	360
Fruits.....	734	Vegetables.....	2,894
Grain.....	5,876	Fish and oysters.....	311
Hides.....	31	Tobacco.....	96
Honey, sirup, etc.....	69	Hay.....	3,300
Lumber.....	123	Total.....	31,511
Merchandise.....	10,975		
Oranges.....	592		

In addition to our steamers crossing Volusia bar there are others running independently and not on regular schedule. Among them is steamer *McNeil*, which carries a large amount of ship stores.

Arrivals and departures of vessels for the year ending December 31, 1900.

	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers.....	294	58,400	294	58,400

Estimated number of passengers carried by water.....	31,047
Estimated percentage of total trade of neighborhood carried by water percent..	32
Probable increase of trade were the improvement completed.....do.....	200

O 4.

IMPROVEMENT OF OKLAWAHA RIVER, FLORIDA.

For description of this stream, the requirements of commerce, project adopted and its modifications, methods used, work accomplished, its cost, and the results obtained, see pages 1314 to 1316, Report of the Chief of Engineers for 1896.

There were no operations on this stream during the past fiscal year.

The sum of \$15,000 still remaining unappropriated of the amount originally estimated as the cost of the projected improvement of this river, in addition to \$2,000 required for maintenance, could be profitably expended during the fiscal year ending June 30, 1902.

Money statement.

Amount (estimated) required for completion of existing project	\$15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901:	
For works of improvement.....	\$15,000.00
For maintenance of improvement.....	2,000.00
	17,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for improvement and maintenance of Oklawaha River, Florida.

September 19, 1890.....	\$10,000
July 13, 1892.....	1,000
August 18, 1894.....	3,000
June 3, 1896.....	3,000
March 3, 1899.....	3,000
Total.....	20,000

COMMERCIAL STATISTICS.

Commerce of Oklawaha River during year ending December 31, 1900.

[Furnished by R. J. Adams.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cotton.....	1	Merchandise.....	565
Fertilizers.....	23	Ship stores.....	3,800
Fruits.....	4	Vegetables.....	27
Grain.....	270	Hay.....	125
Hides.....	2	Total.....	4,847
Honey, sirup, etc.....	16		
Lumber.....	14		

Remarks: Logs towed, 2,225,000 feet. Millions of feet of cypress and pine cross-ties taken out by other parties.

Arrivals and departures of vessels for year ending December 31, 1900.

	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers.....	160	3,850	160	997

Number of passengers carried by water, 8,000.

O 5.

IMPROVEMENT OF ST. AUGUSTINE HARBOR, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, see pages 1316 and 1317, Report of the Chief of Engineers for 1896.

The amount appropriated by the river and harbor act of August 18, 1894, being inadequate to carry out the work designed, it has been held in reserve for emergencies that may arise as a result of storms. Considerable erosion has taken place in the vicinity of the inner two groins on the south side of the entrance. In accordance with instructions from the Department dated March 23, 1901, a project was submitted for the expenditure of the funds available. It was deemed inexpedient to carry out the work.

There were no operations during the year ending June 30, 1901.

Money statement.

July 1, 1900, balance unexpended	\$6,000. 10
July 1, 1901, balance unexpended	6,000. 10

Appropriations for improvement of St. Augustine Harbor, Florida.

August 11, 1888	\$35,000
September 19, 1890	20,000
July 13, 1892	10,000
August 18, 1894	6,000
Total	71,000

COMMERCIAL STATISTICS.

From information furnished by Thomas B. George, collector of customs, there was no water commerce at this port during the year ending December 31, 1900.

O 6.

IMPROVEMENT OF INDIAN RIVER, FLORIDA.

(1) INDIAN RIVER, BETWEEN GOAT CREEK AND JUPITER INLET.

For a description of this locality, the requirements of commerce, the project adopted, methods of improvement employed, work accomplished and its cost, attention is invited to the Report of the Chief of Engineers for 1896, pages 1318 to 1320.

No funds being available, there was no work done on this portion of the river during the fiscal year.

This portion of the river is of sufficient importance to warrant early completion of the projected improvement. The balance (\$29,000) of the estimated cost of the improvement could be profitably expended during the fiscal year ending June 30, 1903.

(2) NEGRO CUT.

For a description of this locality, project, and work done, attention is invited to Reports of the Chief of Engineers for 1894, pages 1227 et seq., and for 1896, pages 1318 and 1319.

Of the funds available \$5,000 is for dredging and the balance for the construction of a training wall to protect the dredged channel. The project adopted contemplates the removal of the shoal places which have formed in the dredged channel and the construction of a training wall of palmetto, brush, and stone with the dredged material deposited over it, the work to be done by hired labor, using the U. S. dredge *Suwanee*.

The *Suwanee* became available for the work in the early part of May, 1901. Necessary repairs were made upon her at Tampa, Fla., from May 9 to May 20. On the latter date she set out under tow for the Indian River. From Key West she proceeded by inside passage under her own steam to Miami. It being necessary to make the remainder of the trip on the outside, a portion of the dredging outfit was shipped by rail to Fort Pierce. She arrived at Fort Pierce, Indian

River, on June 6, 1901. The dredging apparatus was installed and a survey made for the purpose of determining the dredging to be done and the best location for the training wall. On June 25 dredging was commenced on the shoal at the inner end of the cut, and to June 30 1,986.9 cubic yards of material had been removed.

It is estimated that an appropriation of \$1,000 annually, or \$2,000 biennially, will be required to maintain this channel.

(3) JUPITER INLET.

For description of this locality and work done, see Report of Chief Engineers for 1897, page 1554.

Information having been received that this inlet had closed again, an examination was made January 29, 1901. It was ascertained that the inlet had become completely closed about January 10, and that the citizens of that locality were endeavoring to reopen it. The importance of keeping the inlet open being realized, an allotment of \$800 from the emergency river and harbor appropriation of June 6, 1900, was made for the purpose. This amount being inadequate, an additional allotment of \$200 from the same appropriation was made February 28. An opening was made February 19, but a sudden and violent storm arose the following night, which closed it again. The river began falling, and there being no immediate prospect of its rising to give a sufficient head of water on the inside to make the undertaking a success, work was suspended March 13 until more favorable conditions should obtain. A very heavy rain having occurred, raising the river so as to give the necessary head, the citizens of that vicinity, taking advantage of the work already done by the United States, were enabled to successfully open the inlet June 13. It was reported that on the following day the channel through the inlet was 200 feet wide and 8 feet deep.

Money statements.

INDIAN RIVER, BETWEEN GOAT CREEK AND JUPITER INLET.

{ Amount (estimated) required for completion of existing project.....	\$29,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903.....	29,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.....	

NEGRO CUT, INDIAN RIVER INLET.

July 1, 1900, balance unexpended	\$12,726.60
June 30, 1901, amount expended during fiscal year	1,585.47

July 1, 1901, balance unexpended	11,141.13
July 1, 1901, outstanding liabilities.....	997.99

July 1, 1901, balance available.....	10,143.14
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{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901.....	2,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.....	

JUPITER INLET.

Amount allotted from emergency river and harbor appropriation act of June 6, 1900		\$1,000.00
June 30, 1901, amount expended during fiscal year		969.25
July 1, 1901, balance unexpended		30.75
July 1, 1901, outstanding liabilities		29.01
July 1, 1901, balance available.....		1.74

Appropriations for improvement of Indian River, Florida.

July 13, 1892 (between Goat Creek and Jupiter Inlet)	\$15,000
August 18, 1894 (Negro Cut)	5,000
March 2, 1895 (Negro Cut)	15,000
February 26, 1896 (Jupiter Inlet)	500
June 3, 1896 (Negro Cut)	7,500
March 3, 1899 (Negro Cut)	5,000
Total.....	48,000
Allotment from emergency river and harbor appropriation of June 6, 1900 (for opening Jupiter Inlet).....	1,000

COMMERCIAL STATISTICS.

No commercial statistics could be obtained.

O 7.

IMPROVEMENT OF HARBOR AT KEY WEST, FLORIDA, AND ENTRANCE THERETO.

For a description of this locality, the requirements of commerce, an account of early attempts at improvement, present project, methods used, work accomplished on east jetty, and results obtained, see pages 1325-1327, Report of the Chief of Engineers for 1896. For an account of work on west jetty, see page 1371, Report of the Chief of Engineers for 1898, and page 1938, Report of the Chief of Engineers for 1900.

At the beginning of the past fiscal year the channel across the northwest bar had deteriorated so that a draft of only 10 feet at mean low water could be carried through it.

The mean range of tide is 2.5 feet.

The project needs revision.

At the beginning of the fiscal year there remained a balance of \$333.02 of the appropriation of \$25,000, act of March 3, 1899.

On July 2, 1900, the sum of \$5,000 was allotted from the emergency appropriation for rivers and harbors, act of June 6, 1900, to be expended for dredging on the northwest bar to restore the depth of 12.5 feet. Circular proposals for doing this work were opened July 23, 1900, and an agreement was made with the Stewart Contracting Company to dredge about 10,500 cubic yards at 38 cents, work to begin within 30 days. The contractor's plant was placed in position in August, but bad weather prevented work and the plant sought a harbor until October 23, when another trial was made. Continued bad weather again interfered and the contractor abandoned the work on December 11, 1900. New proposals were invited by circular letter and only one bid was received, which was rejected, the price being too high.

The difficulties, and in fact the practical impossibility, of getting work of this character done by contract in this vicinity, as exemplified

in the experience of the past year, emphasizes the necessity already urged for the construction by the United States of a self-propelled sea-going suction dredge, of moderate draft and large carrying capacity, for dredging not only at Key West Harbor, but also at the other harbors now under improvement in this district, where high prices and inadequate plant have greatly hampered all work done under contract. A suitable dredge for the works of improvement in this district would cost \$150,000.

This is a repetition and reenforcement of the recommendation contained in the report on the improvement of the St. Johns River, Florida, to which reference is respectfully made.

* *Money statements.*

IMPROVING HARBOR AT KEY WEST, FLA.

July 1, 1900, balance unexpended	\$391. 62
June 30, 1901, amount expended during fiscal year	73. 29
July 1, 1901, balance unexpended	318. 33
{ Amount (estimated) required for completion of existing project	200, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	200, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

EMERGENCIES IN RIVERS AND HARBORS.

July 2, 1900, amount allotted	\$5, 000. 00
June 30, 1901, amount expended during fiscal year	208. 63
July 1, 1901, balance unexpended	4, 791. 37
July 1, 1901, outstanding liabilities	17. 15
July 1, 1901, balance available	4, 774. 22

Appropriations for improvement of northwest entrance, Key West Harbor, Florida.

August 2, 1882	\$25, 000	June 3, 1896	\$80, 000
August 5, 1886 (survey)	2, 500	March 3, 1899	25, 000
August 11, 1888	25, 000	Allotment from emergency river	
September 19, 1890	40, 000	and harbor act June 6, 1900 ..	5, 000
July 13, 1892	75, 000		
August 18, 1894	80, 000	Total	357, 500

COMMERCIAL STATISTICS.

Commerce of Key West, Fla., during the year ending December 31, 1900.

[Furnished by the collector of customs, Mr. George W. Allen.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cattle	8, 760	Oranges	47
Fertilizers (including phosphates)	21, 318	Tobacco	415
Grain	15		
Hay	39	Total	30, 594

Number steamboats in trade	19
Number sailing vessels in trade	258
Number passengers carried in 1900	7, 981

O 8.

REMOVING THE WATER HYACINTH FROM FLORIDA WATERS.

For information as to previous investigations and experiments leading to the inception of the project, see Appendixes P 9 and P 11, pages 1612 to 1623, Report of the Chief of Engineers for 1899.

The project for the expenditure of the funds appropriated by the river and harbor act of March 3, 1899, contemplated the construction by contract of a suitable boat equipped with special machinery after designs to be prepared in this office. The designs were in process of preparation when the plans for the special machinery for a boat intended for a like purpose in the Louisiana district were referred to this office for comparison with a view of securing uniformity in design. The plans submitted were so much at variance with those being prepared in this office that it was decided to defer further work upon the latter until after the completion and test of the boat designed for the Louisiana district. Information having been received that the boat had been completed and was in operation on Bayou Plaquemine, Louisiana, Mr. J. W. Sackett, assistant engineer, was directed to proceed to that place and make an examination of the boat, observe its operations, and submit a report thereon. Mr. Sackett made the examination on August 16, 1900, and in his report, submitted September 10, gives a description of the boat and machinery and the methods of operating and the results accomplished. It appears from this report that even with a boat constructed in accordance with the designs in view for the boat for this district, which it is estimated could accomplish six times the amount of work done by the boat in operation in Louisiana, the results would be so meager that very little impression would be made upon the immense fields of the hyacinths in the streams of this district.

In the meantime there had been brought to the attention of this office a certain spraying compound prepared by the Harvesta Chemical Compounding Company, of New Orleans, La., which seemed to possess qualities of sufficient value to warrant an exhaustive test. Accordingly, the manufacturers having furnished a supply of the solution, Mr. Charles Sperry, inspector in local charge of dredging at Orange Mills flats, St. Johns River, Florida, was directed to undertake the experiments under instructions from this office. The place selected for these experiments was in a cove on the west side of the St. Johns River at Bridgeport, about 11 miles below Palatka. The plants were in a very flourishing condition and being out of the current of the river did not move during the experiment. Seven sections of the plants containing an area of 12 square yards each and one containing 300 square yards were experimented upon. The proportions of the compound used varied from one-thirtieth to one-twelfth of a gallon per square yard of plants sprayed, and the experiments were conducted under varying conditions of summer weather and the areas sprayed included all sizes of the plants in various stages of growth from the smallest to the largest, and those in bud, bloom and seed. The experiments covered the period extending from August 10 to September 1, 1900. The deductions from the results of these experiments may be summarized as follows:

The plants sprayed with from one-twentieth to one-sixth of a gallon of the compound per square yard, depending upon the size of the plant,

are thoroughly killed within from five to seven days. An estimate of one-twelfth of a gallon of the compound per square yard is sufficient for the average growth. The effect of the compound upon the plants is noticeable at the tips and edges of the leaves within two hours after they have been sprayed. Rain upon the plants a few hours after being sprayed does not appear to lessen the effect of the compound. As the plant dies it shrinks in volume and the dead plant is easily torn apart, thus offering much less resistance to the passage of boats than when alive. It continues to float after being killed and gradually decomposes and is absorbed by the water or drifts ashore.

While Mr. Sackett was making the examination of the work of the crushing boat in Louisiana he had an opportunity of observing the effect of the use of this compound on the hyacinth in Bayou Plaquemine. The Harvesta Chemical Compounding Company had a contract with lumber-mill owners at Plaquemine, La., to clear a section of 9 miles of the bayou of the plant, and this work was being done at the time of his visit. In his report he states that he was very favorably impressed with the ease and simplicity with which the work was being done and the effect produced. Mr. J. I. Conklin, United States inspector in charge of the construction of the lock at Plaquemine and the crushing boat near that place, has carefully observed the application of the method of spraying, and reports that the spraying process as used there "is the most efficient and economical that can be used for destroying the hyacinth." He states also that though there is a large amount of stock having access to the bayou and that numerous fish are known to be therein, no ill effects to either can be traced to the use of the compound. In this connection Mr. Sperry reported that during the experiments at Bridgeport a cow waded through the section containing an area of 300 square yards, the next day following the one on which the section had been sprayed, and ate a considerable number of the leaves and stalks of the plants, and it appeared to suffer no ill effects therefrom.

The cost of the compound and its application is estimated to be less than one-third of a cent per square yard of plants treated. With a suitable boat fitted with tanks and spraying devices from 30,000 to 50,000 square yards could readily be sprayed in a day's work on large fields of the plant. The very small streams and recesses in the swamps could be reached with rowboats and hand-spraying devices. It will thus be seen that much could be done toward diminishing the pest, and it is not improbable that it could eventually be practically exterminated by this method. A vigorous prosecution of the work would probably entail an expense for operation of \$50,000 for a year's work, in which time it is believed the pest would largely be under control in this district. The vigorous growth of the plant already this season is very alarming to the commercial interests involved, and the adoption of this method and an adequate appropriation to properly conduct it is urgently recommended at the earliest practicable date.

A modification of the approved project with a view to adopting the spraying method was recommended September 28, 1900. It was decided, however, that the funds available could not be expended in the manner proposed without further action of Congress.

Under date of March 26, 1900, there was referred to this office for report a communication of Hon. S. M. Sparkman, inclosing letters of H. C. McRae, in regard to an appliance invented and patented by Mr. Joseph Allen, of Macon, Fla. This invention appearing to possess

features of value which could be made use of in connection with the crushing boat which it was proposed to construct, it was deemed worthy of a test. The inventor being financially unable to provide for the expense of a test, an allotment of \$500 from the unexpended balance of the appropriation for investigation and experiments made in act of June 4, 1897, was made for this purpose.

The test was conducted under the supervision of Mr. Sackett. The experiments were in progress from September 1 to 5, 1900. The device is described in detail in Mr. Sackett's report. Briefly, it consists of a horizontal shaft, to which were attached at right angles a number of knives, each about $2\frac{1}{2}$ feet long. The shaft was held 18 inches or 2 feet above the water by a frame fastened to the bow of the boat and was revolved by machinery at a speed of about 350 revolutions per minute. As to the efficacy of the machine Mr. Sackett reports as follows:

* * * enough was determined to satisfactorily indicate that a more rigidly constructed machine with ample power and positive connections * * * would work successfully. The machine cuts the plants into small fragments, and it is my opinion that while a few of the plants might pass through and survive and grow again the majority of them would be killed and would present very little hindrance to navigation. I am inclined to the opinion that it is about the best mechanical means for the destruction of the plant yet presented, but quite inferior to the chemical means recommended by this office.

This report of Mr. Sackett was submitted after his inspection of the crushing boat in operation in Louisiana. The "chemical means" mentioned is the Harvesta compound and the opinion expressed is concurred in by this office.

The importance to the interests of navigation of clearing the streams of this district of the water hyacinth can not well be overestimated. The financial loss to the lumber industry is very great. On many of the tributaries of the St. Johns River water communication has practically been abandoned and rafting operations have ceased altogether. Even in places on the main river great distress and hardship have been occasioned by small boats being encompassed by masses of the plant. It is frequently dangerous to undertake to cross the river in small craft, even when the opportunity appears favorable. Oftentimes the largest steamers suffer considerable delay and much inconvenience, especially in making landings. In view of the serious condition of affairs, now that there seems to be a prospect of successfully coping with the situation, it is urgently recommended that Congress take the necessary action to enable the funds appropriated in act of March 3, 1899, to be expended otherwise than as provided therein, as heretofore recommended, and that an additional appropriation of \$50,000 be made for operating expenses.

Money statement.

July 1, 1900, balance unexpended	\$35, 426. 77
June 30, 1901, amount expended during fiscal year	476. 35
July 1, 1901, balance unexpended	34, 950. 42

{	Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance unexpended July 1, 1901	50, 000. 00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

Appropriations for removing the water hyacinth, Florida.

March 3, 1899:	
For construction of boat	\$25, 000
For log booms	1, 000
For operating expenses	10, 000
Total	36, 000

O 9.

DREDGE FOR RIVER AND HARBOR IMPROVEMENTS, FLORIDA.

The river and harbor act approved March 3, 1899, contained the following item:

The sum of thirty-five thousand dollars, or so much thereof as may be necessary, is hereby appropriated, to be expended, in the discretion of the Secretary of War, in the purchase or construction of a suitable dredge, with snagging outfit, to be used in connection with the several works of river and harbor improvement on the coast of Florida and the waters tributary thereto.

The inadequacy of the appropriation was pointed out by letter of the Chief of Engineers, January 25, 1900, transmitted to the Speaker of the House of Representatives, with letter of the Secretary of War, January 29, 1900 (printed in House Doc. No. 356, Fifty-sixth Congress, first session). It was recommended that an additional appropriation of \$20,000 be made for the construction of this boat. Subsequent events have shown that this additional amount would be insufficient.

Detailed designs and specifications were prepared during the year, and bids for the construction and equipment of the boat were opened March 7, 1901. The lowest bid received for the construction of the boat complete with all the appurtenances and equipment specified, and delivered at Jacksonville, Fla., was \$67,100.

This boat is primarily designed to take the place of the scow-modeled stern-wheel dredge and snag boat *Suwanee*, which has been in operation in this district since 1888. Numerous small appropriations for dredging and snagging work and the removal of obstructions and repairs to pile work and dikes on the streams in this district which it is impracticable to have done by contract make a boat of this kind a necessity. The *Suwanee* has been remodeled from time to time and much machinery and many special devices have been added to enable the boat to accomplish the great variety of work required. In this respect the boat has been very successful, but it is old and weak, and constant vigilance and many repairs are required to prevent it succumbing to the heavy duty required of it.

The many years experience with this boat has been the principal guide in designing the new boat. The boat must be as small and of as light draft as is practicable, but at the same time must have great strength and must be modeled so far as is consistent with buoyancy required and have sufficient propelling power to make trips in the open sea along a treacherous coast in proceeding from one work to another in the shortest time practicable. A large fuel capacity is necessary. As much of the work is required where it is difficult to procure fresh water, it must be provided with means for furnishing

its own water supply, and to enable it to enter small and treacherous inlets at night to escape an approaching storm an electric searchlight would be of great advantage. The hydraulic dredging appliance must be so arranged that it can cut a channel through places where the water is too shallow for the boat to pass over and at times where the cut is made through places above the level of the water. The boat must also be provided with appliances for removing blasted rock and depositing dredged material upon training walls and dikes in such a manner as at times can not well be done by the hydraulic process. Powerful hoisting machinery must be provided with sufficient capacity to raise and handle heavy live oak snags intact. The various kinds of dredging and snagging appliances must be so arranged that one can be substituted for the other without great loss of time. As the boat would frequently be required to work in isolated localities where fresh provisions can not well be obtained, a refrigerating plant should be provided.

To insure strength and lightness, steel construction is essential wherever practicable.

The above being the general requirements, the boat was designed as shown on the approved plans consisting of 22 sheets of drawings, 5 of which, showing the general plans, accompany this report.¹

The designs for this boat and for the special machinery and equipment required were prepared by Mr. J. W. Sackett, assistant engineer, very ably assisted in the numerous computations necessary and in the drafting by Mr. E. B. Thomson.

Very careful consideration has recently been given these plans with a view of modifying them in order to lessen the cost of the boat, but it has been decided that they can not be changed in any essential feature and still provide for a boat that will satisfactorily accomplish the work for which it is intended.

It is therefore recommended that an additional appropriation of \$35,000 be made to provide for the construction of the boat in accordance with the design submitted.

Money statement.

July 1, 1900, balance unexpended	\$33,107.52
June 30, 1901, amount expended during fiscal year	1,441.84
July 1, 1901, balance unexpended	31,665.68
{ Amount (estimated) required for completion of existing project	35,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	35,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

¹ Not printed.

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Duluth Harbor, Minn.	i, 514; iv, 2883
East River, N. Y.	i, 223; ii, 1248
Ellis Island, New York Harbor, N. Y., near	i, 223; ii, 1248
Erie Lake, off Cleveland, Ohio	i, 584; iv, 3269
Erie Lake, off Sandusky, Ohio	i, 584; iv, 3269
Flint River, Ga.	i, 363; iii, 1793
Fort McHenry Channel, Patapsco River, Md.	i, 272; ii, 1391
Fort Monroe, Va., off	i, 298; ii, 1462
Galveston Bay, Tex.	i, 411; iii, 1959
Gloucester, N. J., off	i, 262; ii, 1351
Greenpoint, N. Y., off	i, 223; ii, 1248
Greenwood, Miss., Yazoo River	i, 420; iii, 2048
Hampton Roads, Va., off Fort Monroe	i, 298; ii, 1462
Hardings Beach, Chatham, Mass.	i, 174; ii, 1147
Haverstraw, N. Y., off	i, 223; ii, 1248
Hudson River, N. Y.	i, 223; ii, 1248
Island Beach, N. J., opposite	i, 223; ii, 1247
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League Island Navy-Yard, Schuylkill River, Pa.	i, 263; ii, 1352
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Louisville and Portland Canal, Ky.	i, 505; iv, 2816
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Michigan Lake-Sturgeon Bay Canal, Wis.....	i, 527; iv, 2970
Mississippi River, above Missouri River.....	i, 440; iii, 2231
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Monroe, Fort, Va., off.....	i, 298; ii, 1462
Nauset Harbor, Mass.....	i, 159; ii, 1091
Newark Bay, off Corner Stake light.....	i, 223; ii, 1247
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New York Harbor, N. Y., Buttermilk Channel.....	i, 229; ii, 1299
New York Harbor, N. Y., Communipaw Channel.....	i, 223; ii, 1247
New York Harbor, N. Y., near Corner Stake light.....	i, 223; ii, 1247
New York Harbor, N. Y., near Ellis Island.....	i, 223; ii, 1248
New York Harbor, N. Y., off Greenpoint.....	i, 223; ii, 1248
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Ohio River, Louisville and Portland Canal, Ky.....	i, 505; iv, 2816
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Port Chester Harbor, N. Y., off.....	i, 223; ii, 1246
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Sandy Hook, N. J.....	i, 229; ii, 1299
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San Jacinto River, Tex.....	i, 411; iii, 1959
San Juan Harbor, Porto Rico.....	i, 657; v, 3635
Savannah Harbor and River, Ga.....	i, 334; ii, 1660
Schuylkill River, Pa.....	i, 262, 263; ii, 1350, 1352
Seabright, N. J., off.....	i, 223; ii, 1247
Ship John light, Delaware Bay.....	i, 263; ii, 1350
Shovelful light-ship, Mass., near.....	i, 174; ii, 1147
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Stage Harbor, Mass., on Hardings Beach.....	i, 174; ii, 1147
Staten Island-New Jersey channel.....	i, 223; ii, 1247
Sturgeon Bay and Lake Michigan Canal, Wis.....	i, 527; iv, 2970
Superior Bay, Duluth Harbor, Minn.....	i, 514; iv, 2883
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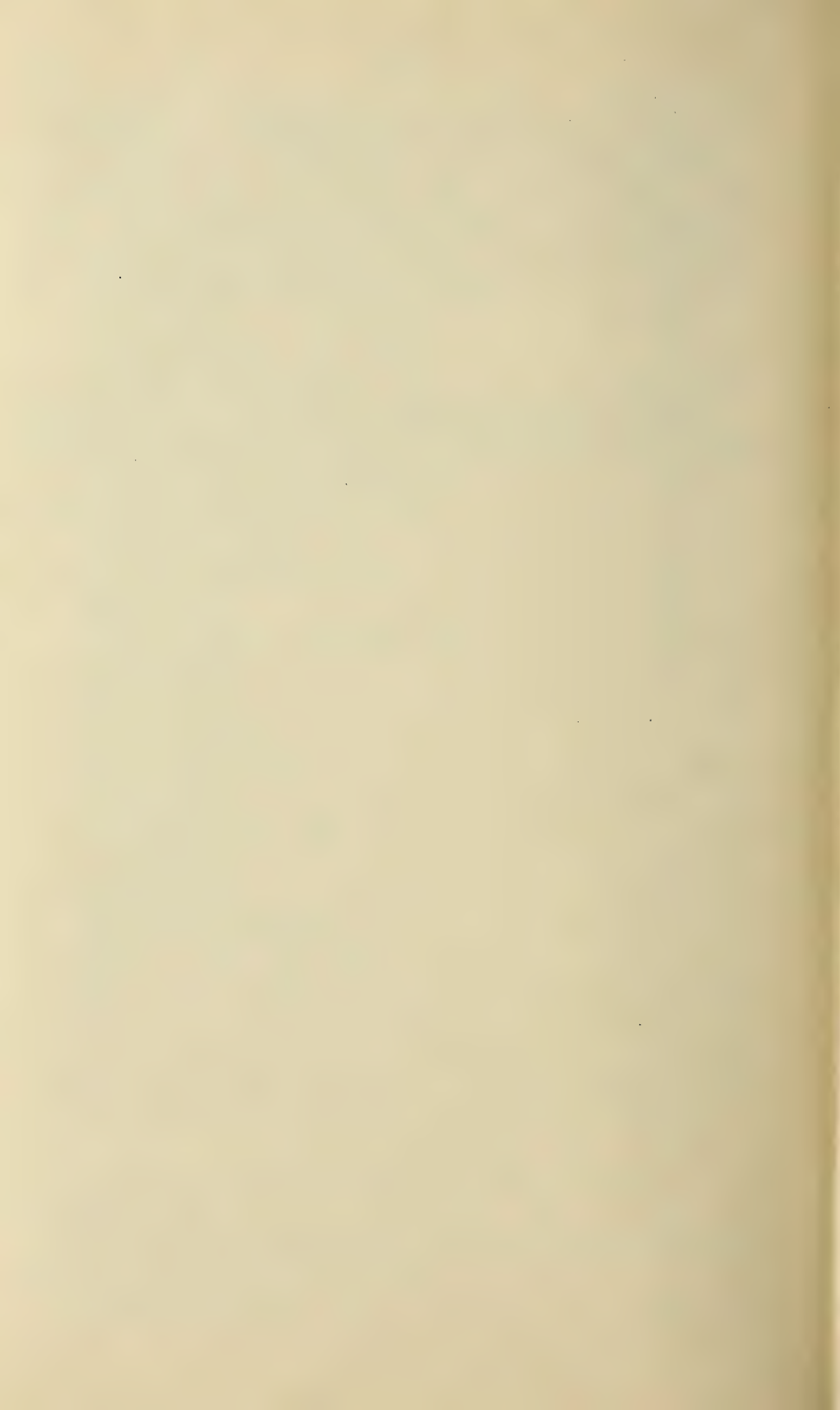
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